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Villas of the Veneto

IV. THE VILLA CORNARO AT PIOMBINO, NEAR CASTELFRANCO

By HAROLD DONALDSON EBERLEIN *and* ROBERT B. C. M. CARRERE

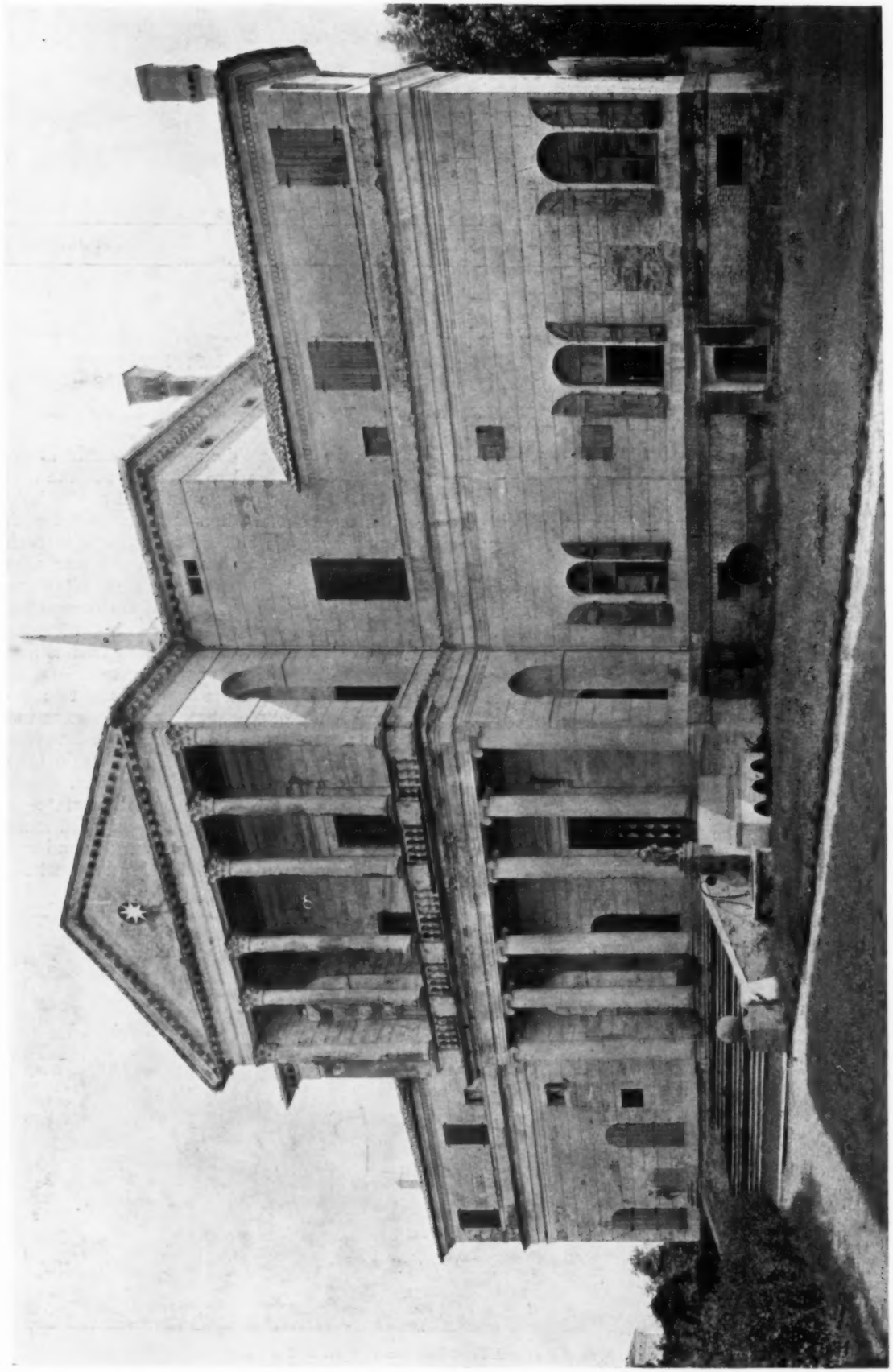
"That house only ought to be called convenient, which is suitable to the quality of him that is to dwell in it, and whose parts correspond to the whole and to each other."

HERE we have in a nutshell Palladio's philosophy of domestic architecture. It is very cogently expressed, and to discern its full force one needs but remember that in his translation Isaac Ware used "convenient" in its broader, seventeenth century sense as "fitting" or "seemly." Messer Andrea was fully sensible of the fact that the very raison d'être of a house is to shelter appropriately the life lived within its walls. He also recognized in equal measure that as the manner of life must necessarily differ for men of different stations in a complex social order, so also must the external expressions of domestic architecture differ to accord with the several estates of those who are to live in the houses.

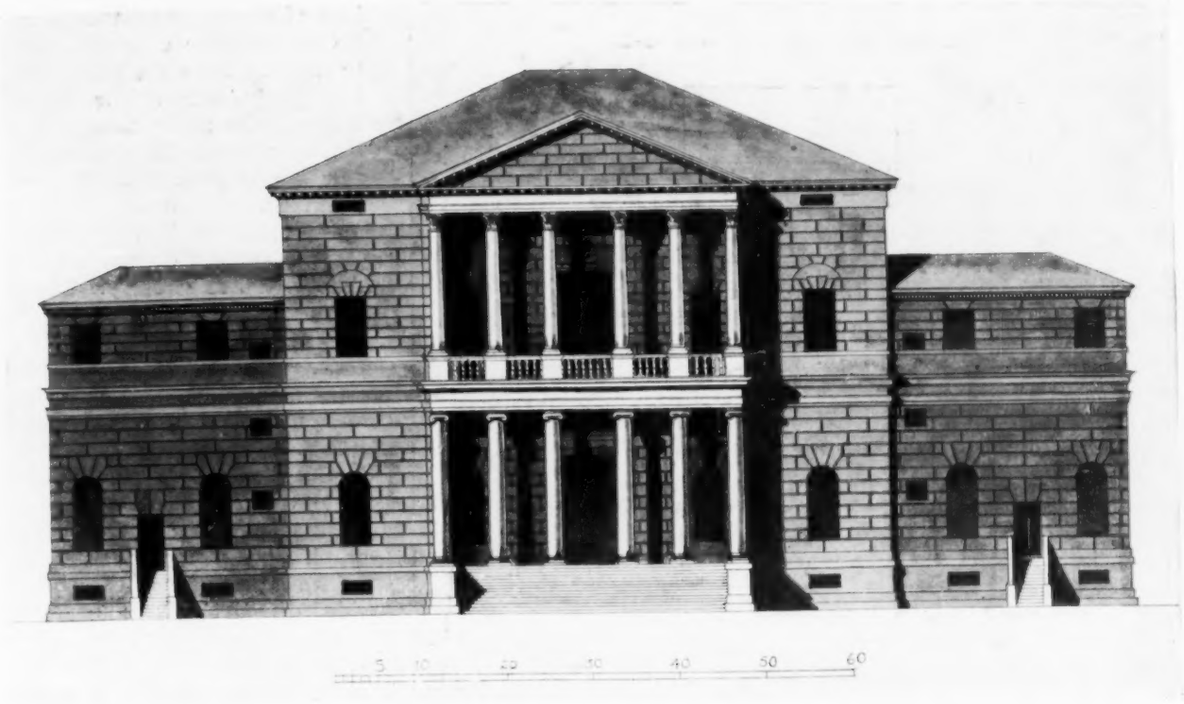
As to the particular form with which he chose to express his convictions in design, let us take his own words when he writes "the architect ought above all to observe, that (as Vitruvius says in the first and sixth books) for great men, and particularly those in a republic, the houses are required with loggia's and spacious halls adorned, that in such places those may be amused with pleasure who shall wait for the master to salute, or ask him some favour"—a thoughtful provision of enticement for these sixteenth century successors of the old Roman "client," as well as for "the virtuous friends and relations" alluded to in a previous paper.

When Palladio penned this generalization regarding proprieties of plan, he may well have had in mind this very villa at Piombino, in the Trevisan Marches. The "magnificent Signor Giorgio Cornaro," for whom the house was designed, was a person of consequence in the Venetian state—a member of a noble family that had supplied more than one doge since the thirteenth century and was destined to supply more—a family upon whose

Villa Cornaro. View of the South Front from Parked Space beyond Gates



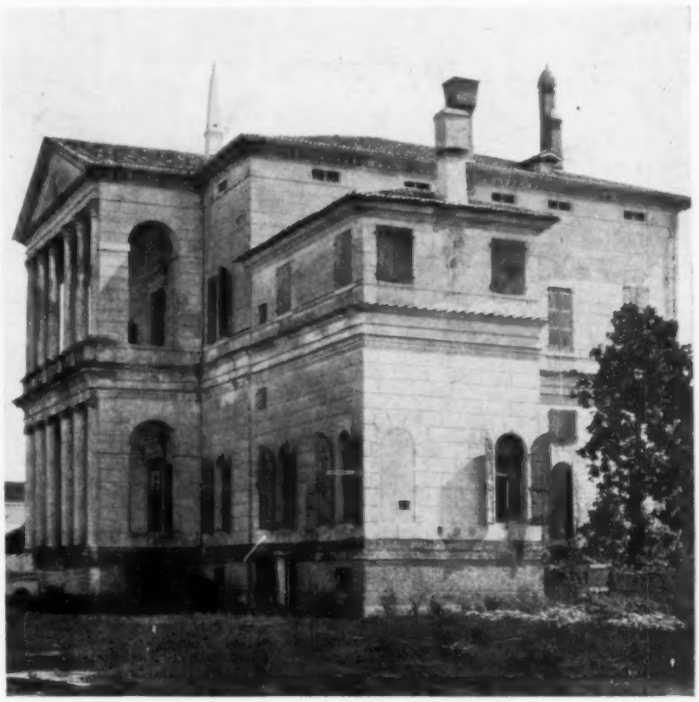
GENERAL VIEW OF THE NORTH OR PRINCIPAL ENTRANCE FRONT
VILLA CORNARO, PIOMBINO, NEAR CASTELFRANCO, ITALY



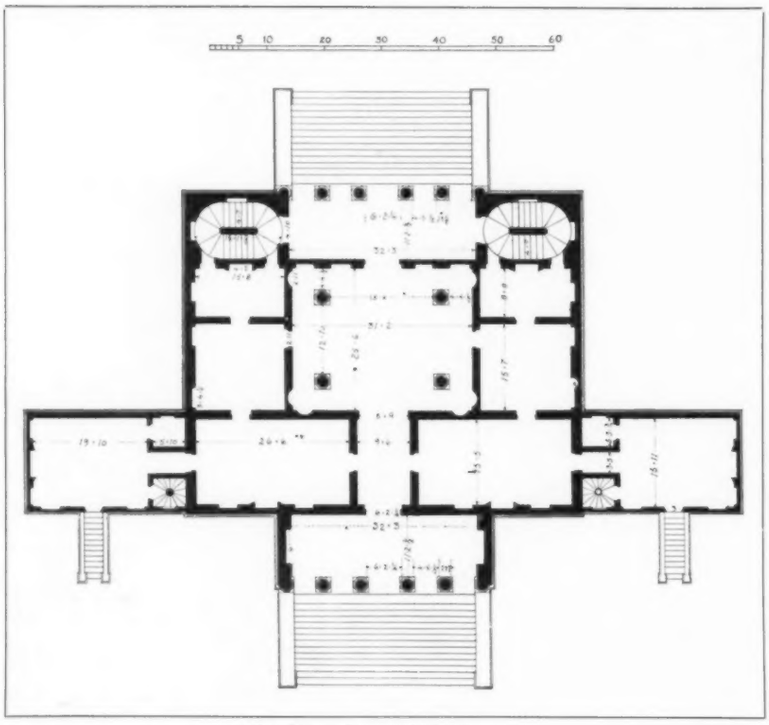
Elevation of North Front after Scamozzi's Drawings

sons the republic, according to its wont with those of ducal rank, was ever ready to impose the fulfillment of exacting public services; a man of wealth and broad interests, and a near kinsman of that ill-starred Caterina Cornaro, Queen of "Jerusalem, Armenia and Cyprus" until the paternalistic government of her native city, coveting her kingdom for its own purposes, forced her to abdicate and sent her to live in a semblance of her erstwhile royal estate at Asolo. It was fitting, therefore, that a noble of such note and connections should have a princely house, and such a house did Messer Andrea build him—about 1570, if the local tradition be correct—a house which Scamozzi properly deemed one of Palladio's most beautiful creations.

"The hall is placed in the most inward part of the house, that it may be far from the heat and cold"—the quotation is from Ware's translation of Palladio—"and the wings where the niches are seen, are in breadth the third part of its length. The columns answer directly to the last, but one, of the loggia's, and are as far distant from one another, as they are high. The large rooms are one square and three quarters long. The height of the vaults is according to the first method for the height of vaults [Bk. I, Ch. 23]. The middle sized rooms are square, one-third higher than they are broad; their vaults are *à lunetti*. Over the small rooms there are *mezzati*. The loggia's above are of the Corinthian order. The columns are one-fifth less than those underneath. The rooms are with flat ceilings, and have some *mezzati* over them. On one part is



West End of Villa Cornaro



Main Floor Plan of Villa Cornaro

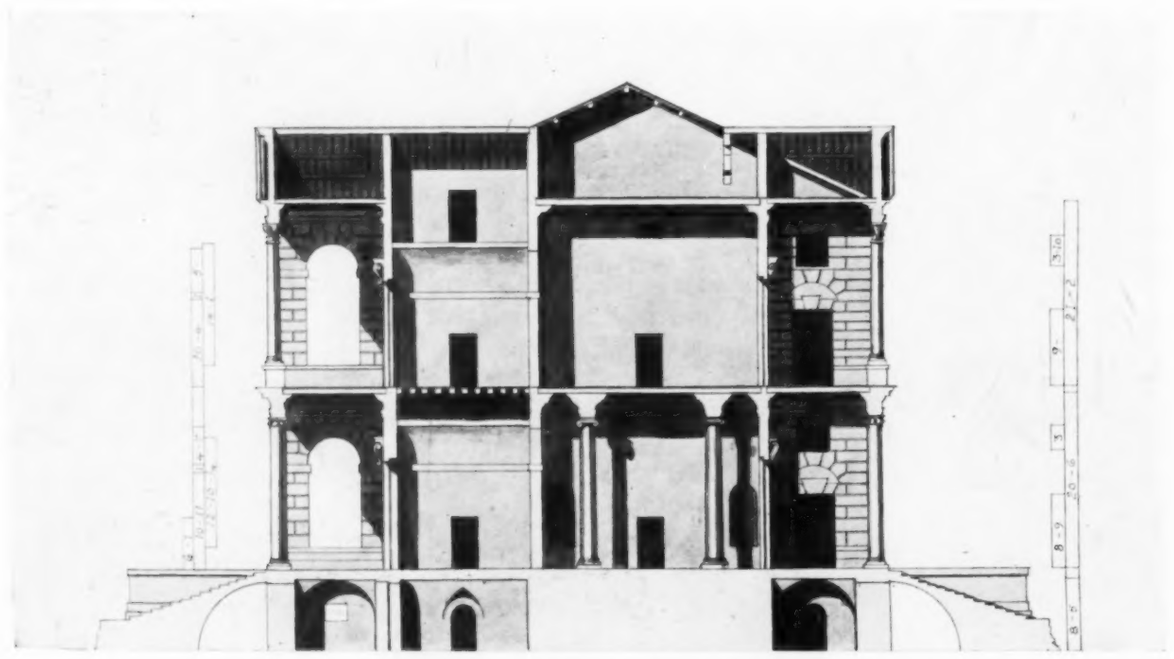
the kitchen, and places for housewifery; and on the other places for servants." Palladio's literary style is not so lucid as it might be, to begin with, and Ware's translation might have been happier, to say the least, but by comparing the description with the plan, elevation, section and the photographic reproductions one may gather an accurate idea of the fabric as it is today.

One caution it is necessary to impress upon the reader before going further. The careful student who undertakes to collate the available documents will observe that Palladio's own drawings, the drawings here reproduced, and the photographic records do not all tell exactly the same story. There are manifest discrepancies, on the one hand, between Palladio's plan, measurements and elevation and the plan, elevation and measurements here published. On the other hand, furthermore, there is not complete coincidence between the last named data and the photographic testimony.

The explanation of this three-sided divergence is this: Palladio published plan, measurements and elevation as he originally designed them.* Scamozzi (edition Vicenza, 1786), upon the basis of which the accom-

*As Designed by Palladio		As Executed
Width of vestibule	32′	31′ 2″
Length of vestibule	27′ 3″	25′ 6″
Width of entrance passage	10′	9′ 6″
Width of great chambers	16′ 5″	15′ 5″
Length of great chambers	24′	26′ 6″
Square chambers	16′	15′ 7″
Width of cabinets	10′	8′ 8″
Distance between central columns	6′	6′ 2¼″

These measurements are given in the Vicenza foot.

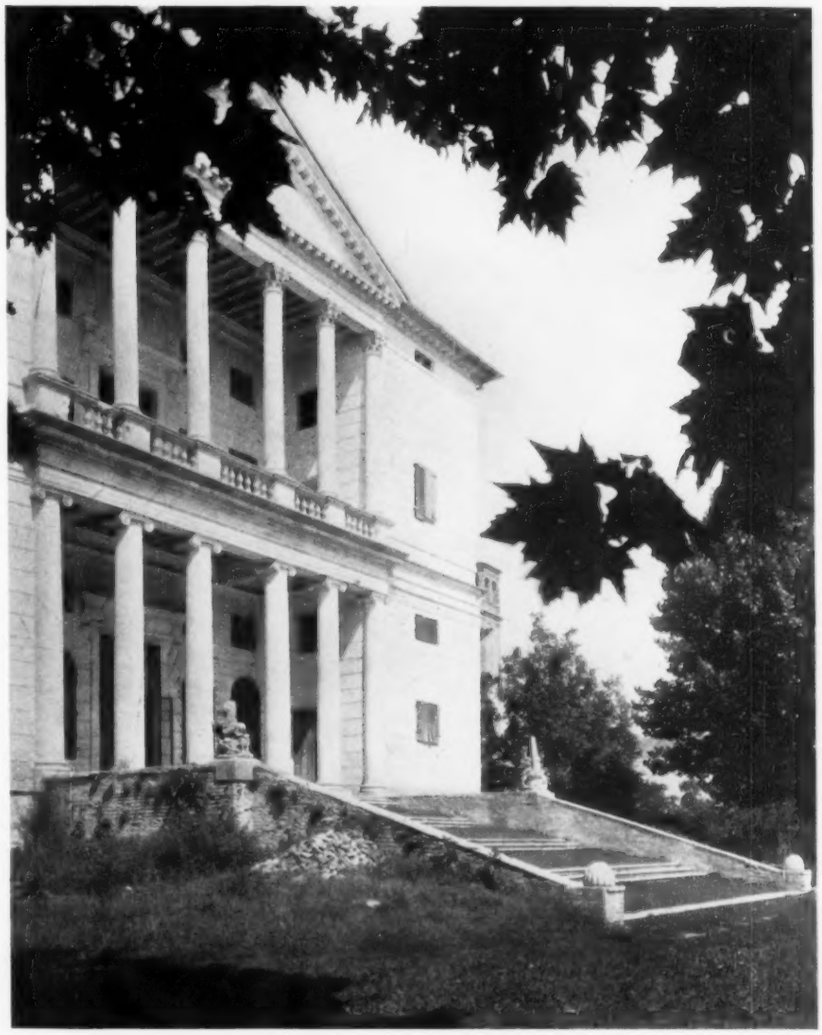


Cross Section of Villa Cornaro after Scamozzi's Drawings

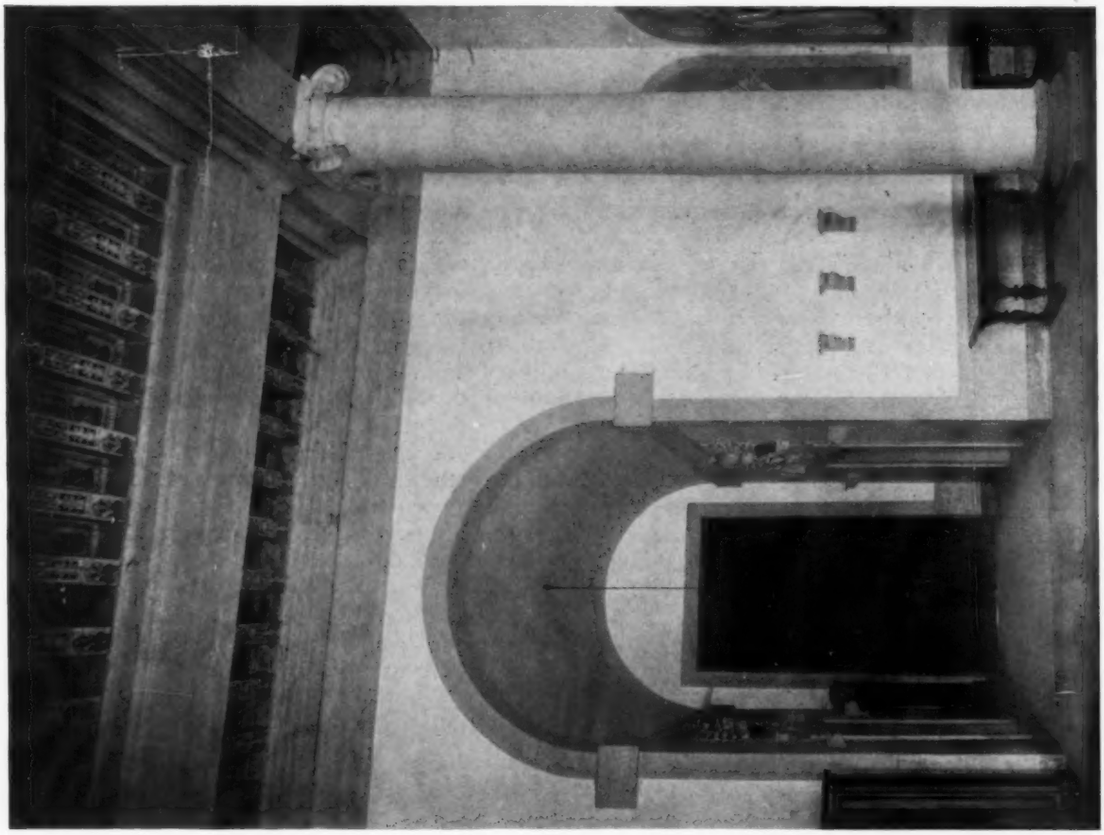
panying plan, measurements, elevation and section are given, with some recent additional verifications, gave the version of the villa as actually built, and was careful to note the most important variations between Palladio's measurements and his own, a table of which appears in the subjoined footnote. In the course of years, sundry changes have been made, such, for example, as removing the steps and blocking up the doors in the wings, and it is the present state of the fabric we find recorded in the illustrations. Between the two last named classes of documents no serious discrepancy occurs, with one exception. In both the Scamozzi and Palladio versions the ascents to the loggias, north and south alike, appear as runs of continuous steps. That they consist of short ramps separated by runs of three steps, that they extend much farther outward from the building than the plans and section indicate, and that the treatment of the balustrades is different from that shown in the elevation, is quite clear from the illustrations. Why Scamozzi did not correct this in his version, whether as an extramural matter he thought it not sufficiently important to change, or whether as a subsequent alteration of Palladio's design he deemed it improper to indicate, it is impossible to say. At any rate, it seemed advisable to let the record stand as shown in the drawings.

As is the case with so many of Palladio's country houses, the Villa Cornaro is built of brick and coated over with an excellent quality of stucco, finished with a *marmorino* surface which has well withstood the effects of time and taken on much the appearance of light limestone, the effect being considerably heightened by the rustication. The shafts of the columns are also of brick, specially shaped, and coated with *marmorino* finished stucco, while the bases are stone and the capitals terra cotta painted or stucco washed. Both Ionic and Corinthian capitals are more refined in detail in the south than in the north loggias. The balustrades of the loggias and the steps are of white Istrian stone, and the ramps, between the runs of triple steps, on the broad ascents to both north and south loggias, are cobbled, and now thickly grown with grass.

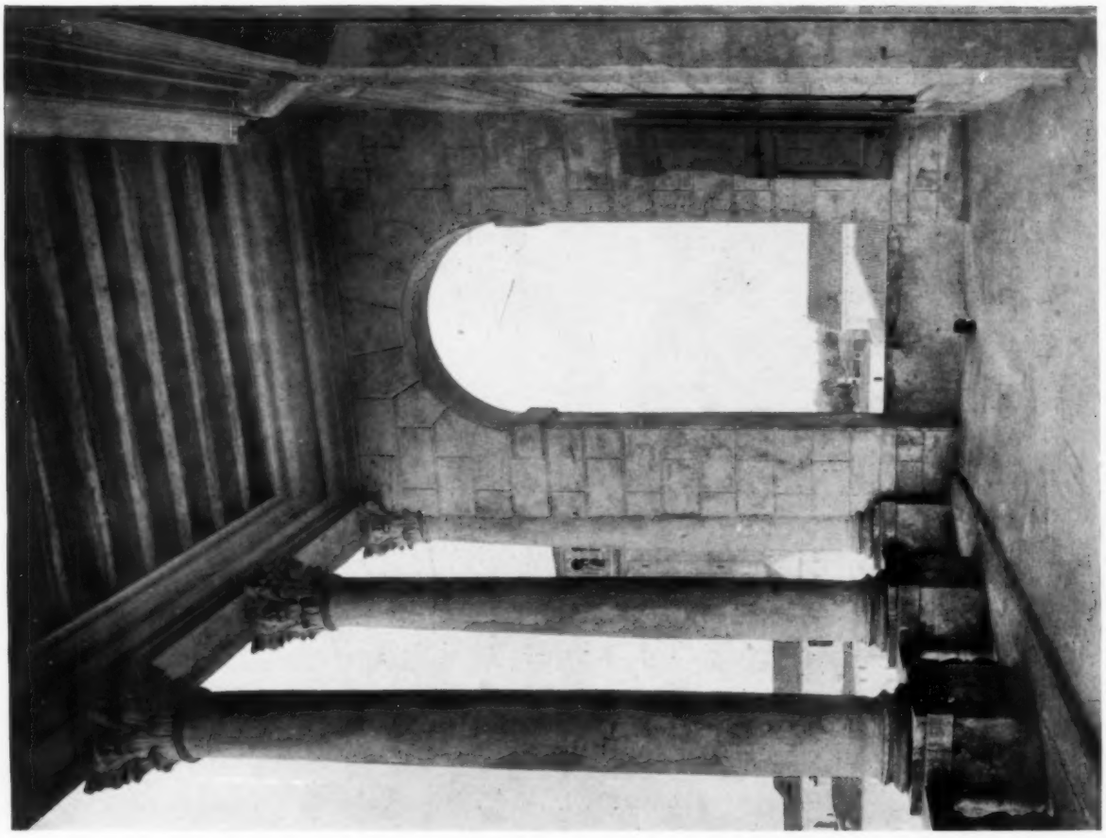
The ground floor loggias are paved with large bi-colored elongated hexagons, each composed of two bricks, one straw colored, the other orange, with the corners clipped to form the hexagon. The same paving is found in some of the rooms, while the others are floored with the large bricks commonly used for that purpose in old Italian houses, or else with terrazzo. In the large enclosed and oval shaped south staircases, which communicate directly with the ground floor and main floor loggias by open doorways without doors, the steps are made of brick set on edge. So far as any paint is left upon the shutters, it seems once to have been green. The roof is of the usual reddish tiles. Inside, the ceiling of the great hall is beamed and bears the original *cinquecento* arabesque decorations in an agreeable combination of white, yellow and dark blue. As the section shows, there is a second great hall on the main floor, directly above



Villa Cornaro. Loggias and Ramp of South Front



GREAT HALL LOOKING TOWARD NORTH DOORWAY



INTERIOR, SECOND FLOOR OF NORTH PORTICO

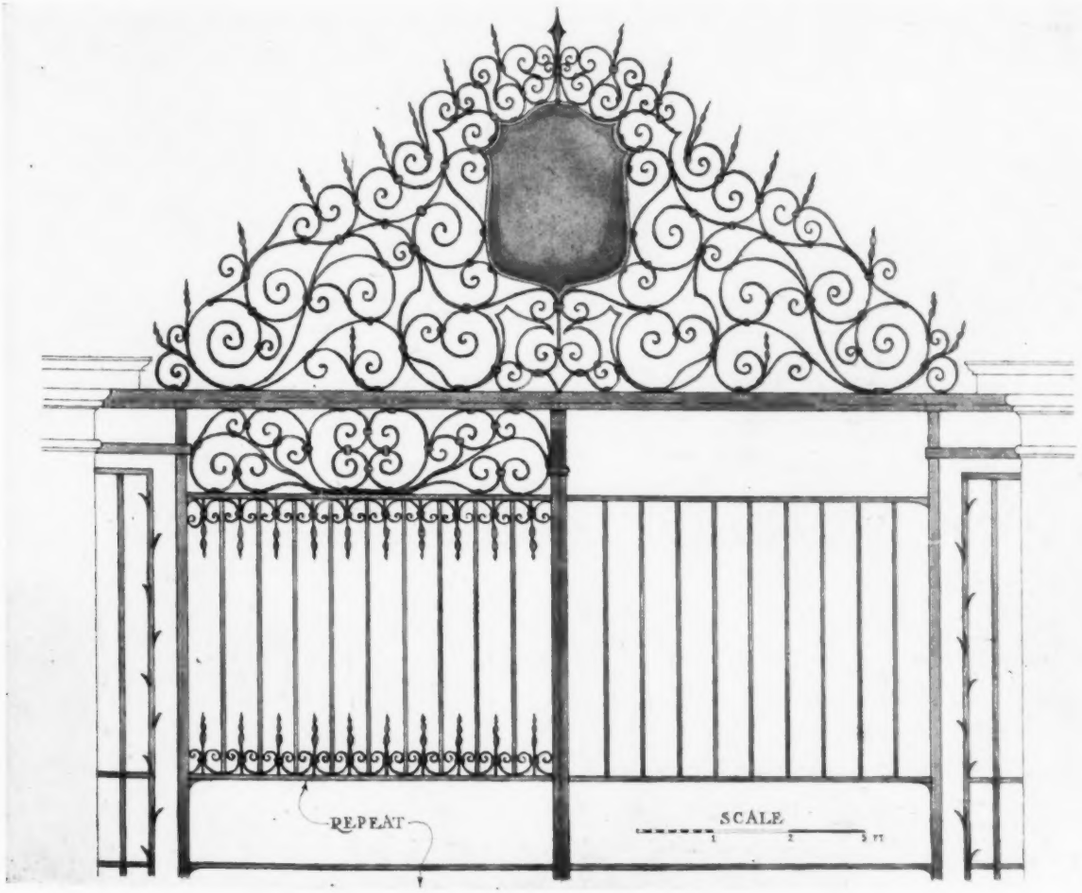
VILLA CORNARO, PIOMBINO, NEAR CASTELFRANCO, ITALY

that on the ground floor, and of the same dimensions. Here also the ceiling is beamed and painted in the same manner as that in the lower hall, only a little more elaborately and with a greater variety of color.

In the seventeenth century the baroque decorators adorned the doorways in the lower hall with highly wrought plasterwork, very good of its kind and admirably executed. They also added stucco embellishments for the chimney-pieces in some of the rooms on the main floor, and likewise contrived ornate plaster frames in several of the ground floor rooms to enclose a series of well conceived but very indifferently executed frescoes of biblical subjects. To the seventeenth century also belong the gates opening on the street, an achievement in wrought iron of such beauty that it somewhat inclines us to forgive the contemporary frescoes just alluded to.

Mr. Fletcher's classification of Palladio's country houses, according to five types of plan, is probably familiar to the reader:—(1) block type, without wings; (2) central block with quadrangle; (3) central block with straight wings; (4) central block with quadrant wings; and (5) central block with returned wings. The Villa Cornaro belongs to

Entrance Gates, North Front



Villa Cornaro. Detail of Ironwork of Entrance Gates on North Front
An addition made in XVII Century to original work

the third type, but in disposing the layout Palladio departed from an arrangement to which he appears to have been partial and which, indeed, he expressly mentions as an important detail to be observed in the planning of villas—that "the covertures for the things belonging to a villa, must be made suitable to the estate and numbers of animals; and in such manner joined to the master's habitation, that he may be able to go to every place under cover, that neither the rains, nor the scorching sun of the summer, may be a nuisance to him, when he goes to look after his affairs." The stables and other accessory buildings are set separately at a little distance from the house, and lie along the road, with an arcaded portico opening upon the grounds. A thoroughly practical and worthy piece of composition, thus, the north side, but not nearly so imposing and stately as the arrangement to the south of the house.

Here a broad *tapis vert*, bounded east and west by lofty avenues of plane trees, extends a goodly distance to the park gates, set just at the far side of the bridge, which spans a little stream and what were once fish ponds, but are now overgrown with reeds and become breeding places for the "molesting gnats and other small animals" that Palladio cautions his clients against, "which are generated by the putrefaction of still fenny waters." Beyond the gates there opens out another and greater rectangular lawn enclosed by trees and hedges, behind which run clear rivulets. Again, beyond these bounds there stretch the fields of the estate. Thus, as one stands in either of the south loggias, the eye commands an extensive and agreeable prospect. In this immediate region, flat and possessed of no striking natural beauty in itself, the villa and its grounds are so contrived that they make a spot of genuine delight to the eye.

The more one studies Palladio's country houses at first hand—and the Villa Cornaro is an admirable example to cite in support of this observation—the more is one filled with admiration for the ingenuity of the master who could use the same limited number of motifs and stock "properties" over and over again, and yet dispose them in ever new combinations, without repeating himself or incurring the risk of having one of his compositions mistaken for another.

Plaster Doorway in Great Hall

Plaster Decorations Framing Frescoes

Embellishments on Ground Floor, Made in Baroque Period of XVII Century

Ramp Design in Public Garages

By HAROLD F. BLANCHARD, AUTOMOTIVE ENGINEER

THIS is the second of a series of articles to be presented in THE FORUM *by members of the Consultation Committee on their respective subjects. Others of equal value and interest are in preparation.* — THE EDITOR.

THE popularity of the ramp as a means of inter-floor transportation has increased very rapidly in the last three or four years. There was a time when elevators were used almost exclusively for multi-storage garages, but it has been gradually realized that there is much to recommend the ramp for the transportation of self-propelled vehicles. The ramp obviously is much older than the elevator; in fact, it antedates the stairway. It is nothing more or less than an artificial hill, and consequently was man's first means of moving from one level to another. Then came the staircase which, however, was mainly suited for the inter-floor movement of human beings. As a means for moving goods its use was largely limited to what a man, or perhaps several men, could carry. Hence, the hoist was introduced and from that the elevator was developed. The freight elevator is a logical device for the movement of goods of all sorts, but the introduction of automotive vehicles, themselves possessing the power to climb or descend from floor to floor if a roadway was offered, changed the problem. This partly explains the growth of the use of the ramp.

The chief objection to the ramp is the fact that it often takes up considerable space. Just how much space it occupies depends on circumstances, including the size of the plot and how well the building is laid out. It also depends on the type of ramp used. At least one type of ramp, from a space-economy standpoint, compares very favorably with the single elevator. Even the ordinary ramp, although it often requires a great deal more space than a single elevator, has frequently been used because of the advantages it offers. It is cheaper to install and involves no upkeep cost. There are no moving parts and there is nothing to get out of order. It is part of the building itself; its capacity is almost unlimited. Cars may be run up or down in quick succession whereas the elevator has a very definite capacity limit.

Owners of automobiles invariably prefer the ramp because it provides quick and easy inter-floor transportation. There are no serious delays as with an elevator. The ramp is easily, instantly available. It makes every floor a straight floor. The objection to upper stories is almost completely removed. Owners and drivers of motor trucks are equally enthusiastic. In the storage of motor trucks it is almost a rule that all the trucks in the garage will go out within a period of half an hour or so in the morning and come in during a similar period at night. Because of this fact there must be means of handling a large capacity one-way traffic. The elevator is at its best when it is handling simultaneously two-way traffic, carrying a car up and bringing one down. The ramp is at its best when handling traffic in one direction, therefore the ramp is particularly desirable in a truck garage since it permits the emptying of a building in a few minutes in the morning and the filling of the building with equal ease at night.

In first approaching the question as to whether to use ramps or elevators it is necessary to consider whether one or more elevators will be necessary. Ordinarily one elevator will handle the work in a garage of 125-car capacity. In other words, if the building houses 500 cars, four elevators would be required. This figure, of course, must vary with different buildings and different requirements, but it is, nevertheless, a good average figure. One elevator would be sufficient for a garage having 150

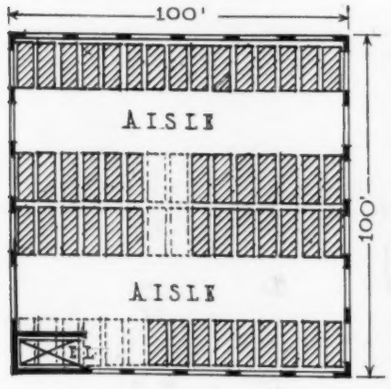


Fig. 1. Elevator Garage
Capacity 50 cars. Space for 6 cars occupied by elevator and approach

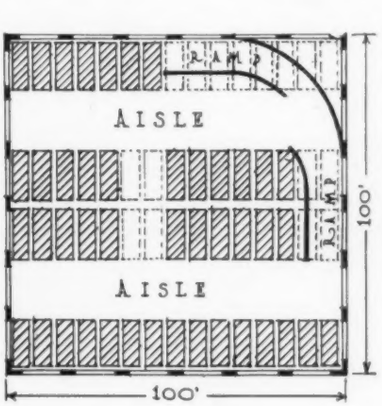


Fig. 2. Ramp Garage
Capacity 44 cars. Space for 12 cars occupied by ramp. Floor layouts vary

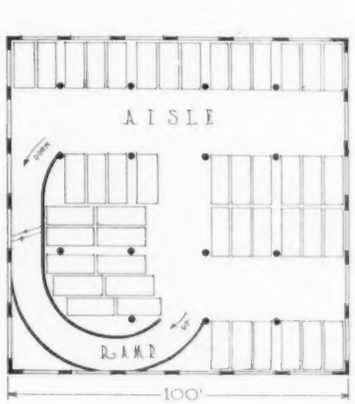


Fig. 3. Garage with Improved Ramp
Capacity 46 cars. Space for 10 cars occupied by ramp. Floor layouts identical

cars on three floors. Also a single-track ramp would be satisfactory for this building. Such a building would probably be 100 x 100. The elevator would be located in one corner and it would probably occupy a space which could be devoted to six cars. This figure includes the necessary approach to the elevator and it assumes an average elevator location; see Fig. 1.

A ramp design for the same building would probably vary from floor to floor but, on the average, it would occupy space which might be devoted to twelve cars. In other words, the ramp takes up six more car spaces than a single elevator. Notwithstanding this fact, the ramp is usually preferred because of the reduction in first cost, the absence of cost of upkeep, and the ideal service which it usually offers.

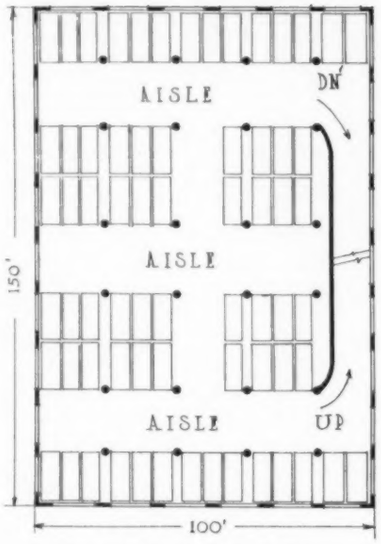
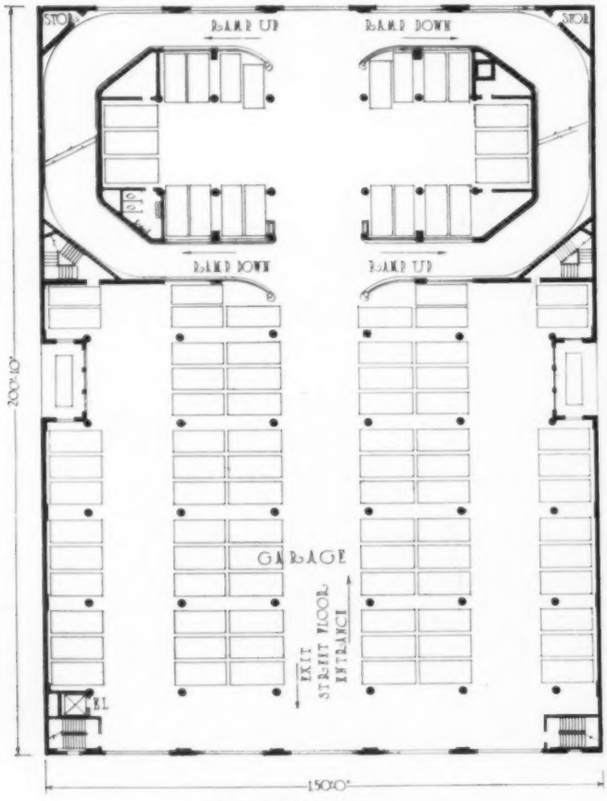


Fig. 4. Plan with Straight Ramp
This type is more economical in space than curved ramp but requires a floor depth of 150 feet

If a single elevator breaks down, the garage is out of business until it is repaired and for this reason a second elevator is often installed, adding to the expense. Advocates of the elevator often object that the ramp is not satisfactory because a broken down car cannot be taken up it. This is not true, however, because any good touring car is powerful enough to tow another machine up a 15 or 20 per cent ramp grade.

The ramp is often considered preferable to an elevator, even in a service station, because there are no parts to get out of order, no upkeep expense, and its capacity for transporting cars is much greater than the elevator's capacity. Furthermore, it is easier to tow a disabled car up the ramp directly into the repair shop than it is to disconnect the tow car at the elevator, raise the disabled car to the designated floor, and then remove it from the elevator. This is particularly true when one end of the car is so badly smashed that it must be lifted by the tow car.

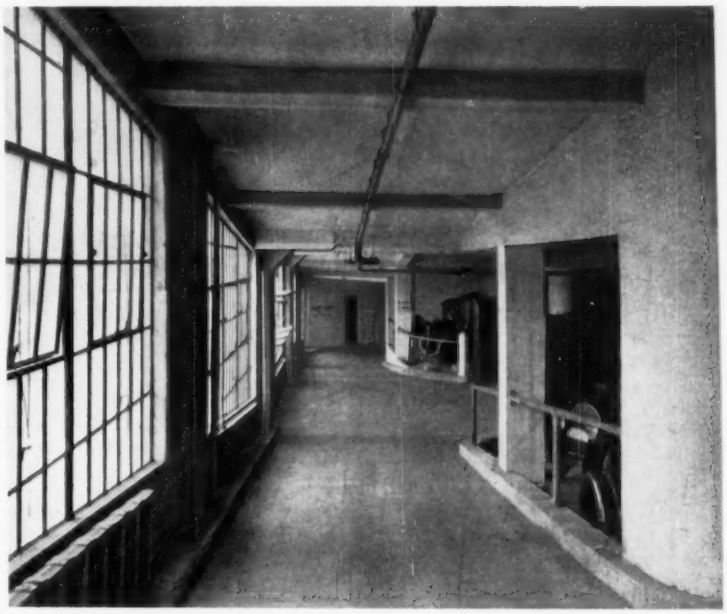
The ramp has an advantage in the eyes of the average garage operator which cannot be calculated in dollars and cents. It is a sales talking point, the importance of which cannot be overestimated. However, if it is desired to make a comparison between a ramp and an elevator on a strictly economic basis, it is easily done, although the exact figures must vary according to the elevator considered, the height of the



Floor Capacity 99 Cars

Fig. 5. Exterior and Plan. Commodore-Biltmore Garage, New York
Warren & Wetmore, Architect

building, and so on. Nevertheless, for an average case it may be assumed that the elevator costs $5,000, that repairs and depreciation per year will total $500, and that the cost of electric current will be $750. The interest on the investment at 6 per cent will be $300, making a total annual expense of $1,550. To this must be added the salaries of the elevator operators, if necessary. The usable space that the elevator occupies in a building should also be added to the expense. In other words, if the elevator takes up space sufficient for six cars per floor the rent that might be obtained from these spaces should be figured in. On the other hand, the cost of the ramp is entirely represented by the cost of the usable space it occupies. It is not fair to figure, in the case of the ramp, any addition for construction because the ramp will cost no more than equivalent floor space secured by ordinary building construction.



View of Ramp along Rear Wall, Commodore-Biltmore Garage
Warren & Wetmore, Architects

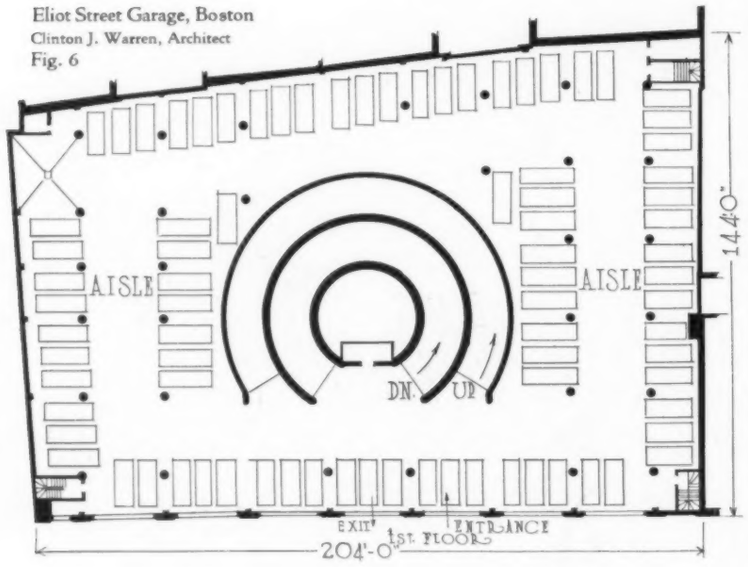
Many interesting facts have been developed regarding ramps within the past few years and from an examination of buildings already erected it may be said that few ramps have been laid out so as to fit their buildings as economically as possible. Here is a subject that demands the closest study, because the revenue to be obtained from the building depends upon how many cars can be stored in it. The design of the garage, by the way, is different from that of most other buildings because automobiles are large, bulky objects which can only be moved forward or backward. The conditions, therefore, under which a garage operates are very different from those found in an office or a factory. The ramp or elevator location and column spacing mean everything in a garage, whereas they mean comparatively little in a factory or an office building.

Many hold the view that a ramp is only suited to a large building, but it may be said positively that there are few buildings which are so small that they may not include a ramp properly designed. Perhaps the quickest way to get at the question of efficient ramp design is to consider the faults of some typical layouts that have been developed.

Fig. 2 shows the usual design for a building 100 x 100. This layout is for the second floor. The ramp rises along the right side of the building, from the first floor front, and swings in under the rear aisle. A continuation of this ramp goes on up to the third floor and perhaps from there to the fourth. It will be noted that the entrance to each floor is at a different point because of the type of ramp used; also, on the second floor the ramp takes off a slice of one side and one end of the building. This naturally has a serious effect on car storage. It subtracts space from all floors, but unfortunately the space subtracted is different on every floor. In other words, a ramp of this design raises havoc with the layout. The layout on every floor must be different, and yet the columns of all floors must have the same location. The objection, therefore, to this design, and to many ramp designs, is the fact that the floor pattern is different on every floor. Therefore, the desirability of so locating the ramp that it gives a uniform floor layout is a matter of prime importance. In the building in question, the easiest way of achieving this result would be as shown in Fig. 3. In fact it might be said, as a rule, that wherever a uniform floor pattern is desired it may be obtained by locating the ramp system as a flight of stairs and using the aisles to travel from one ramp to the next. The objection to both plans, Figs. 2 and 3, is that the curving of the ramp takes up a great deal of useful space. Therefore, it must be concluded that the straighter the ramp the less space it will occupy. It is difficult to make a straight ramp of ordinary design fit in a building 100 x 100. It is quite feasible, however, to place a straight ramp in a building 100 x 150, as shown in Fig. 4.

Fig. 5 shows the floor plan of the Commodore-Biltmore Garage in New York. This garage is of interest because it is one of the first to have a uniform floor pattern, and the layout shown is typical of all floors as far as the ramp is concerned. One ramp is for up traffic and the other for down. A car entering the garage swings to the right, up a ramp to the second floor, where it crosses the center aisle and reaches the third floor by way of a ramp on the left hand side of the building. Crossing the center aisle again it reaches the fourth floor up a ramp on the right hand side. The down ramps are alternately placed between these up ramps; there-

Eliot Street Garage, Boston
Clinton J. Warren, Architect
Fig. 6



fore, a car coming down from the fourth floor would take a ramp on the left hand side to the third floor, and then on the right hand side to the second floor, thence on the left hand side to the ground floor.

This ramp design is excellent from an operating standpoint, excepting that the turns happen to be a trifle too sharp, the result being that large cars are likely to scrape their fenders. There are few garage locations where this would happen. In this section of New York, however, large cars are the rule rather than the exception. In many parts of the country this ramp design would be more than ample as far as turns are concerned, the occasional large cars being placed on the ground floor. This ramp gives easy access to the upper floors and there is little interference between up and down traffic streams. The ramp is open to the objection, however, that by its very nature it must be made long—too long. In other words, the grade must be made much less than it need be. There is also considerable waste space at the turns. The grade is about 8 per cent where it may be twice this figure. A close study of the layout will show that it would be impossible to use this ramp design on the plot shown, and yet alter the dimensions so that a steeper grade might be employed to give more car storage.

The steeper the ramp grade is, the shorter the ramp becomes, and therefore the less space it occupies. Consequently, it is desirable to make the ramp as steep as possible and yet not too steep to be fully satisfactory. For a passenger car garage there is no reason why the grade should be less than 15 per cent and 20 per cent is not entirely objectionable, although 20 per cent is about the limit. A 20 per cent grade, by the way, is as steep an incline as the average car in good condition can ascend on second gear.

Start of Ramp in LaSalle Garage Showing Fire Door
Holabird & Roche, Architects

Another garage design that has attracted a great deal of interest is the Eliot Street Garage in Boston, Fig. 6. Two concentric ramps are placed in the center of the building—one ramp for up traffic and another for down traffic. The circular space inside the inner ramp is not utilized. Traffic on both ramps is in the same direction, which feat is accomplished by sloping the inner and outer ramps in opposite directions instead of in the same direction, as might be expected. The ramp system is ideal from an operating standpoint. There is no conflict in traffic stream. When a car enters the building it can move directly on to the up ramp to the upper floors, or on the down ramp to the basement. Both these openings are facing the driver. Likewise, in going down, the car proceeds straight out of the building or, in coming up from the basement, it goes straight out. It will be seen, therefore, that no matter what the path of the car, it does not cross the path of any other car. This is an advantage when traffic is heavy, although it is an advantage which is often overestimated as to its importance. A car in moving up or down through the building moves a certain distance on the main aisle once each revolution. It will be noted that the paths of up and down cars are entirely separate. There is no conflict of motion.

The disadvantage of this design is due to the enormous amount of space that the ramp takes up. The outside ramp is approximately 90 feet in diameter, which is to be expected inasmuch as the inside ramp has a circle of about 60 feet. The

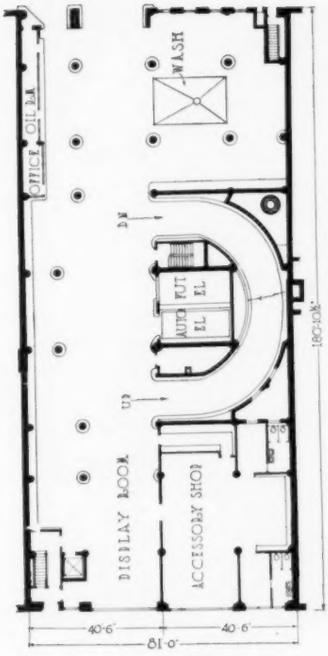


Fig. 7. First Floor Plan, LaSalle Garage, Chicago

Exterior of LaSalle Garage, Washington Street, Chicago
Holabird & Roche, Architects

ramps are broader than necessary. This plan illustrates one of the defects of the concentric arrangement of up and down ramps. In a large city garage it is hardly feasible to make the turning circle of less than 60 feet, and this, of course, applies to the inside ramp; yet if this is done the diameter of the outside ramp cannot be less than 80 feet, assuming that the ramps are 10 feet in width. Obviously, a circle 80 feet in diameter is a large space to devote to inter-floor transportation.

The LaSalle Street Garage in Chicago, Fig. 7, contains a noteworthy feature in that a ramp is used for traffic in one direction and an elevator for traffic the other way. In the morning, when the heavy traffic is *up*, the elevator is used for light *down* traffic, and at night, when *down* traffic is high the elevator is used for light *up* traffic. This garage is used largely by men who drive to business; if it were in a residential section the traffic streams would be in just the reverse directions. This elevator and ramp combination has much to recommend it, but it is a mistake to think that it suits all buildings. In small and medium sized garages a single ramp without an elevator is enough. The same ramp will serve quite satisfactorily for up and down traffic. On the other hand, very large garages will require separate ramps for the two traffic streams. The ramp and elevator combination, however, is deal for all large garages where traffic is heavy in only one direction. Traffic in the other direction, being small, can be handled by a single elevator. The ramp design in this garage is rather wasteful of space, occupying area useful for storing cars.

Where a building is long and narrow, say of 50 or 60 feet frontage and 150 or 200 feet in depth, an ordinary ramp may be placed as shown in Fig. 8. The ramp starts at one side of the building, swings around to the end and then up the other side and,

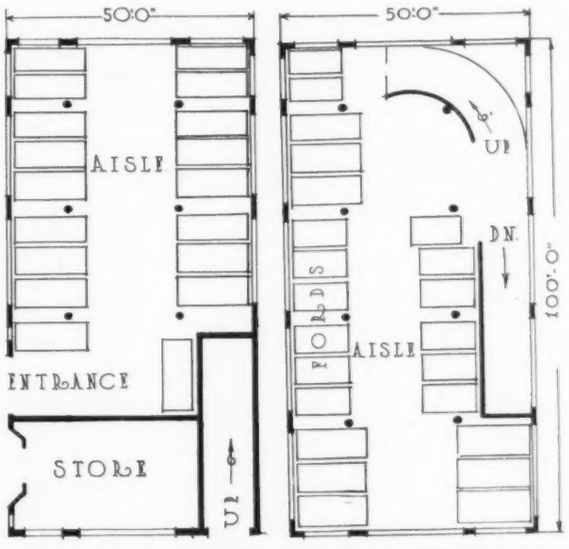


Fig. 8. First and Second Floor Plans Showing Efficient Design of Ramp in Narrow Building

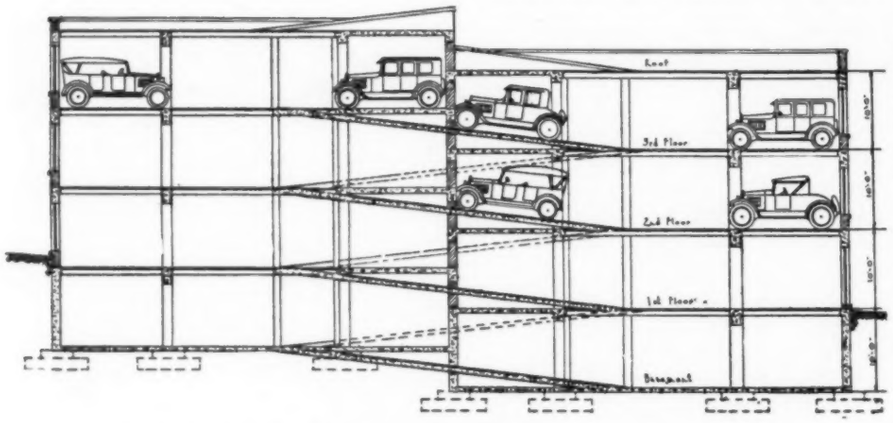


Fig. 9. Section through Garage Showing Patent Ramp Design with Staggered Floors

if the building is high enough, may circle around the front. At first glance this seems to be an inefficient design, but it works out well in buildings that are 60 or 70 feet wide. In fact it works out better in buildings of this width than it does in some larger buildings.

Where possible, it is advisable to make the turning circle 60 feet in diameter, but if the building is narrower there is no serious objection to using a smaller circle; in other words, if a building is 50 feet in width, obviously the circle cannot be any more than this diameter. The majority of cars made today will turn in a 50-foot circle, and in many towns practically all cars to be stored in the garage will turn within this circle. The few cars turning in a larger circle may be placed on the first floor. There are really very few automobiles built today which require more than a 50-foot circle, and there is only one machine now being manufactured that requires more than 60 feet and that is the Locomobile. It is poor economics, however, to design a building for Locomobiles, when it is considered that their number is so small that many garages in the country will never be called upon to house a car of this make.

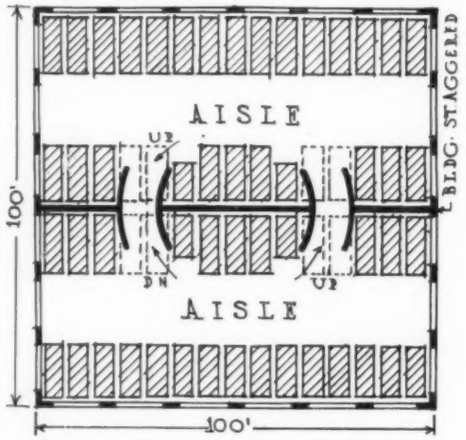


Fig. 10. Typical Floor Plan of Garage with Patent Ramp Design and Staggered Floors. Capacity per Floor 52 Cars

The width of the ramp curb should be from 9 to 12 inches; the outside curb had best be made 12 inches and the inside 9 inches, and it is advisable to make the inside curb 9 or 10 inches high. The distance between curbs should be 8 or 9 feet, making the total width of the ramp 10 or 11 feet.

In truck garages the ramp circle need not be over 80 feet and many truck garages are designed with a 60-foot ramp curve. There are some trucks that require more than 80 feet to turn in, and many require more than 60 feet, but it is assumed that these trucks will be stored on the ground floor. It should be obvious that the larger the circle the more space the ramp must take up, and this holds true whether the ramp is a complete circle or is built as straight as possible. Therefore, every effort should be made to keep the circle as small as possible and still satisfy requirements.

Within the past two or three years patents have been issued on several special ramp designs, among which may be mentioned a design in which the whole floor of the garage slopes. Originally this design was helical in form but eventually it was modified to fit a square building. It is much more economical of space than the ordinary ramp design, but it possesses the disadvantage of having a sloping floor and special steelwork and forms must be used throughout.

Fig. 9 shows a patented design in which the building is divided into two parts, the floors in the two sections being staggered. In most cases the floors of one section come halfway between the floors of the other section, although where equal length ramps are used the floor spacing may be changed.

The floors in the two sections are connected by inclined passages or ramps, each ramp rising one-half story at a time. The path of a car going up through the building from the street would, therefore, be from the first floor in the first section up a ramp to the first floor in the second section one-half story above, and from thence up a ramp to the second floor in the first section and so on. The ramps in this system are half the usual length and, therefore, the system is particularly suited to small buildings; in fact there are few buildings so small but that this ramp system can be used satisfactorily. Cutting the length of the ramp in half makes it almost as easy to locate the ramp in this system as it is to locate an elevator in the building. In other words, the building may be laid out first and the ramp located afterwards, whereas with the ordinary ramp it is almost necessary to fit the ramps in first and then decide how the cars are to be arranged.

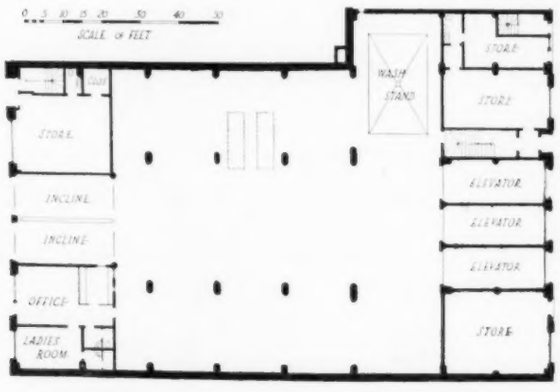
One of the most important features of this ramp is that it rarely takes up more space than a single

elevator, or rather a building equipped with this system has as much or more storage space than it would have with one elevator. The two are compared in Figs. 2 and 10. It will be noted that the economy of this system lies in the fact that the space used for a connecting passageway in Fig. 1 becomes a ramp in Fig. 10; therefore this space does double duty. It also permits the use of the same layout pattern on all floors. Another advantage is that the ramps may be open. It is not necessary to box them in as is usually done with a long ramp. The open sides make it easier for a driver to see. It is necessary to wall in the ordinary ramp in order to obtain fire protection, a rolling door going on one end of the tunnel. With the arrangement shown in Fig. 10 a dividing fire wall is part of the building design and the fire doors are located in line with this wall; therefore, it is not necessary to wall in the ramps. The dividing wall greatly reduces the insurance, and this as well as other features helps reduce the slight additional cost because of this construction.

The most usual mistakes in designing ramps deserve special attention. In the first place, it is quite frequent to find a double-track ramp where a single-track ramp would do. There are few garages that are large enough to require separate tracks for up and down traffic. In the ordinary garage, housing 200 or 300 cars, a single-track ramp is ample.

Ramps of ample size are sometimes designed with right-angle corners which are extremely difficult to negotiate. If a right-angle turn is used it is advisable to curve the curb to guide the car, and if this is not done, at least the turn should be ample enough so that there will be no difficulty about scraping fenders on the walls of the garage. On the other hand, many ramps are designed with turns that are so ample that much valuable space is wasted. A tiled line in the floor and leading up the center of the ramp is an excellent guide for motorists.

It is sometimes said that ramps are dangerous. However, it is questionable as to whether any ramp is as much of a menace as an elevator with its open shaft. It is true that a car may get out of control on a ramp, but as a matter of practical experience brakes have to be in extremely bad shape to be so ineffective as to permit a car to run away on a 15 or 20 per cent grade. Those who doubt this statement should make a practical test of the matter. Looking at the question from another angle, no car has any business on the highways if its brakes are not sufficiently powerful to hold it on a 20 per cent grade. In the hilly sections of the country 20 per cent grades are frequently encountered and there is never any complaint among motorists in ascending or descending inclines of this degree of steepness, nor will they complain when a hill of this degree is found in a garage.



THIS garage contains space for about 444 cars, or about 82 to a typical upper floor with none in the distributing aisles. Each floor is provided with apparatus for washing two cars at one time, and the elevators extend to the roof.

PORTLAND STREET GARAGE, BOSTON, MASS.
ANDREWS, RANTOUL & JONES, ARCHITECTS

General Business Conditions and Building

THERE is particular reason at this time for architects' keeping in close touch with general business conditions. Changes are taking place rapidly, but they are not occurring simultaneously in all industries nor to the same extent in all sections of the country, and inasmuch as the development of building depends to so large a degree upon the general attitude of business men and in recognizing opportunities for securing favorable conditions in materials and labor, it is definitely to the advantage of the architect to know the relative conditions of different industries and general price movements so that he may apply his energies where they will be most productive.

For many months the building industry has made probably the least favorable showing. It is, therefore, a distinct encouragement to note that building conditions in the fall months have shown a very appreciable improvement. An index of present activity is had from the total represented by contracts awarded in the 27 Northeastern states, as reported by the F. W. Dodge Company. This total is $246,186,000, the largest monthly total in the current year, and a record for September in any year. This shows a gain of 11½ per cent over the total for August, which itself was 14½ per cent greater than the average value of contracts let in the month of September during the last ten years.

Although price reductions have been important, a contributing factor of perhaps equal importance to this gain is the renewed confidence brought about by general economic improvement. Forced liquidation of stocks is completed as attested by the index numbers of wholesale commodity prices. Bradstreet's index records the first upward turn in more than a year on July 1 and a further slight increase has been shown in each subsequent month.

The activity noted in building this fall has been reflected, to a greater or less extent, in raw materials and in industrial lines, but it is not generally agreed that the present activity necessarily is the beginning of continued improved conditions. There is an element of seasonal demand, which must be recognized as contributing considerable reason for the present favorable conditions. Steady business in practically all lines is dependent upon the stabilization of prices, and there is as yet no assurance that present prices are stabilized, but the average tendency of prices, not only in the United States but in foreign countries as well, toward a slight rise or continuance on a level, would indicate that further changes in the price situation would be brought about comparatively slowly.

In connection with materials used in building, reports that reach us indicate smaller stocks on hand than is usual at this time of year and likewise a comparatively brisk demand, which conditions, of course, are favorable to maintaining prices on a firm basis. Thus the shipments of Portland cement during the third quarter of this year established a record, approximately 33,970,000 barrels being distributed in that time. Production likewise in this quarter established a record, yet the stocks on hand for the month of September showed 135,000 barrels less than the average September stocks for the last five years. A large portion of this cement is going into the construction of concrete roads, it being estimated that possibly 20 per cent of the output is used in this work. The remainder, however, is largely used in the building trades and provides an indication of the very large amount of building that has been put under way.

In the brick industry the same conditions may be observed, the relation between orders on hand and stocks showing steady improvement in the demand for brick, and this has resulted in not necessarily an increase in the price of brick but an equalization of prices. In the report of the common brick industry for the month of September the composite price is quoted at $13.80 as compared with $13.87 for August, but the variation between the highest and the lowest prices has been greatly reduced from that of previous months. In the steel industry the increase in the tonnage of unfilled orders of the Steel Corporation, as reported September 30, is the first monthly increase since July, 1920, and offers further evidence of definitely better business conditions. Money is becoming cheaper, and this should continue owing to the very excellent condition of the banking situation. In the bond market interest rates are decidedly lower than earlier in the year, and money for their purchase is plentiful. This condition is favorable to easier funds for building construction because the margin of return between short and long term securities is gradually lessening. Indication of the country's financial strength is seen in the report of the Guaranty Trust Company for October 31, which reports that in the first nine months of 1921 some $756,000,000 in new state and municipal bonds was placed on the market, which is well above the previous record of $520,000,000 for the same period in 1919, and that during the month of October an additional offering of $60,000,000 in federal farm loan bonds was well received.

All of these factors are bringing nearer a realization of the general activity which is needed in building in order to make up the deficiencies in construction which the recent Unemployment Conference found was estimated in value at from 10 to 20 billions. They mean that building which has long been contemplated will begin to take definite form, and architects, as their particular responsibility, should exert every effort to follow the trend of prices in materials and labor, the available stocks and their location in view of transportation costs, so that they will be in a position to provide their clients with every advantage of lowest cost.

SMITH MEMORIAL HALL, UNIVERSITY OF ILLINOIS, URBANA, ILL.

JAMES M. WHITE, ARCHITECT

G. E. WRIGHT, ASSOCIATE ARCHITECT

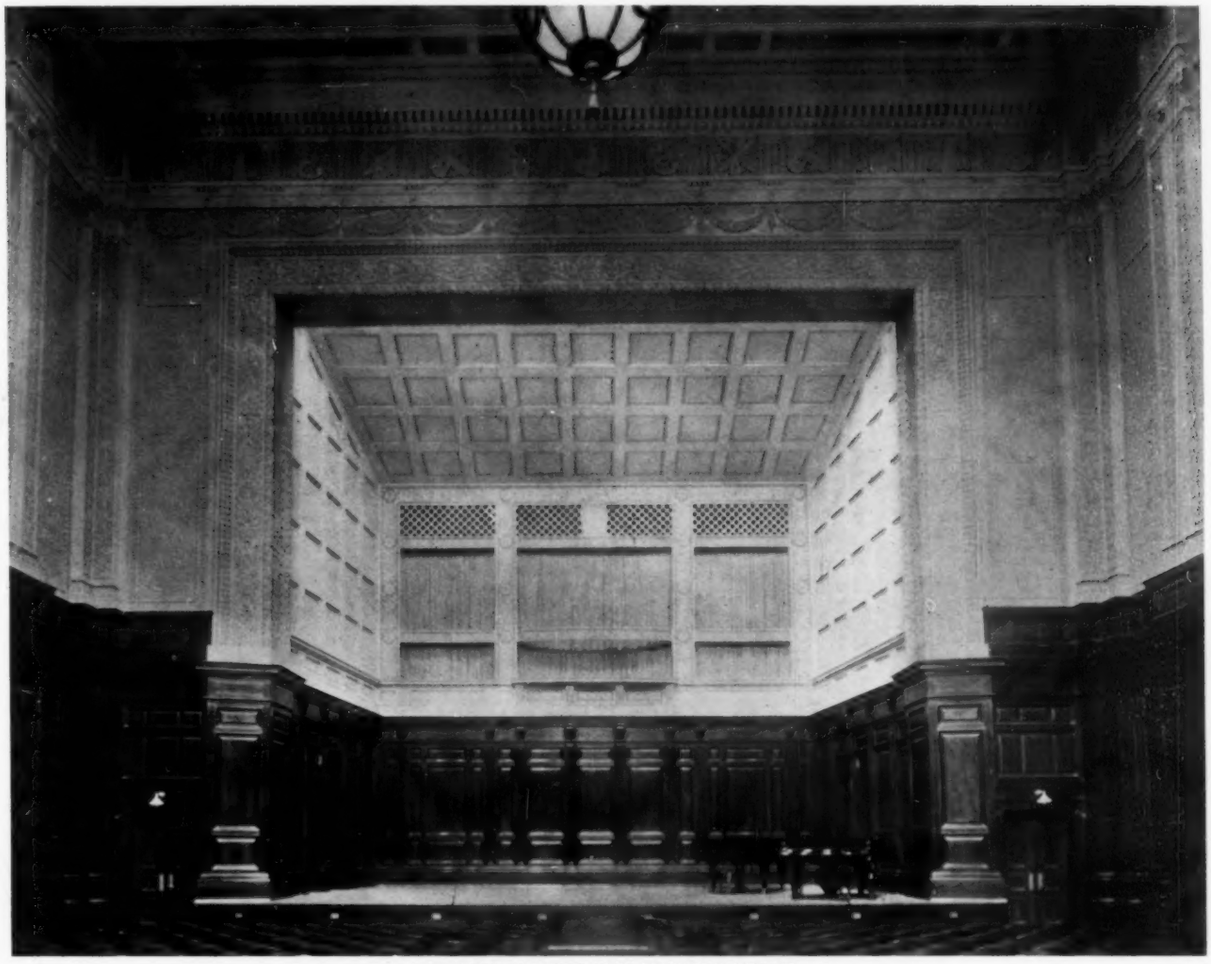
DETAIL OF MAIN FACADE

DETAIL OF MINOR ENTRANCE

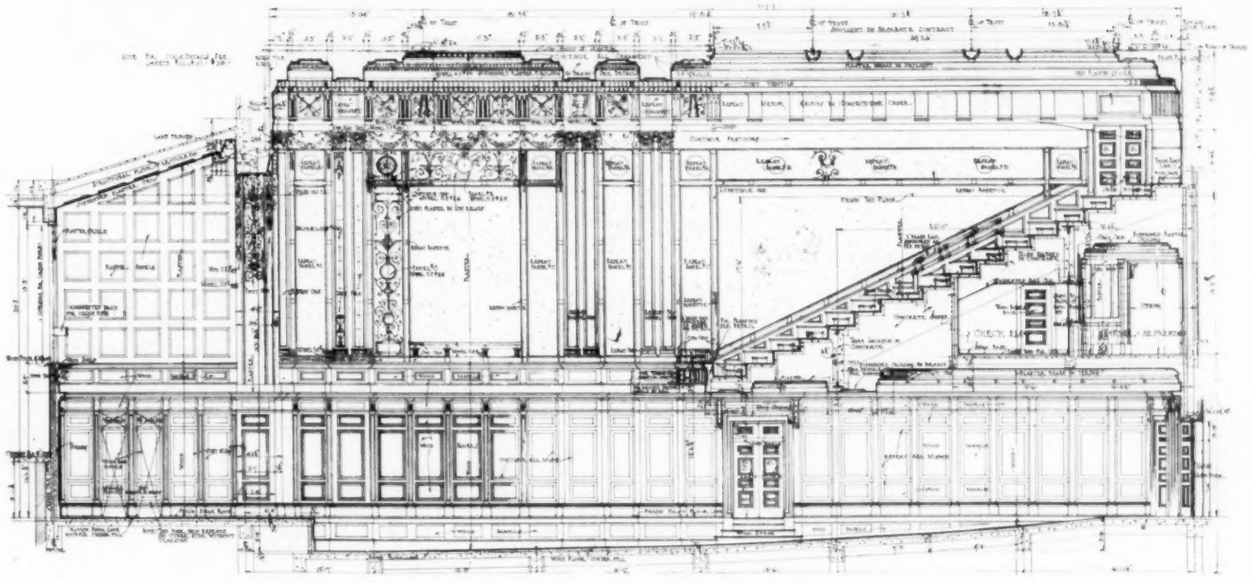
SMITH MEMORIAL HALL, UNIVERSITY OF ILLINOIS, URBANA, ILL.

JAMES M. WHITE, ARCHITECT

G. E. WRIGHT ASSOCIATE ARCHITECT



VIEW OF AUDITORIUM TOWARD STAGE



LONGITUDINAL SECTION THROUGH AUDITORIUM

SMITH MEMORIAL HALL, UNIVERSITY OF ILLINOIS, URBANA, ILL.

JAMES M. WHITE, ARCHITECT

G. E. WRIGHT, ASSOCIATE ARCHITECT

A Western School of Music

SMITH MEMORIAL HALL AT UNIVERSITY OF ILLINOIS

By WILLIAM MACY STANTON

FIFTY years are but a day in the history of the pyramids of Egypt or the Parthenon at Athens or even in that of certain of the old universities of Europe, but in the past 50 years there has grown up in the corn belt of the Middle West a great university. Set down in the vast, fertile prairie, 128 miles from Chicago, is the University of Illinois,—53 years ago an infant university, established by an act of the state legislature,—today a great modern university of 8,000 students, whose homes are located in every state in the union and in almost all foreign countries. Its scholastic standing is long established and recognized throughout the educational world; its athletic teams have been victorious in meets and contests everywhere. The growth of the university may be said to typify the development of the part of the country where it is located.

Illinois, one of the richest states in the union, supports the university by generous appropriations, so the tuition is a very nominal sum, well within the reach of every aspiring boy or girl. The land is acquired, buildings are erected, and equipment purchased out of state funds. It is therefore unusual to find at such an institution a personal gift such as the Smith Memorial Building. Having been in use only one school year, this building stands as one of the newest on the campus.

Captain Thomas J. Smith, a former member of the Board of Trustees of the University, gave toward the funds for the erection of this building which was to be known as the Smith Memorial Music School, and to be dedicated to the memory of his wife, Tina Weedon Smith. She had loved music and had devoted her life to the uplift of musical education and desired that this education be available to all classes of people.

The Smith Memorial Building is located on the campus at the southeast corner of the present quadrangle, close to the university auditorium. The architecture of the auditorium dictated the style, and in a certain sense the feeling of the whole building, as the cornice heights are the same in both buildings. Brick, the logical building material for this clay country, was used, with Indiana limestone trim. The brick surfaces are relieved in places by polychrome tile and marble inserts. The Italian renaissance style was used wherever it did not conflict too seriously with the lines and materials of the auditorium. One request of Captain Smith was a Memorial Room in which portraits of himself and his wife would be permanently hung, and this room is located on the second floor in front of the recital hall, with its windows facing into the portico.

In this modern, well equipped Memorial Building is housed the School of Music of the University of Illinois. Completely separated from all the great musical centers of the country and hundreds of miles from New York, this school of music has grown up and now flourishes in a modern temple dedicated to its study.

View of Smith Memorial Hall from the University Campus
James M. White, Architect, G. E. Wright, Associate Architect

Soundproofing a Building

STUDY OF RESULTS AT SMITH MEMORIAL HALL, UNIVERSITY OF ILLINOIS

JAMES M. WHITE, *Supervising Architect of the University.* G. E. WRIGHT, *Associate Architect*

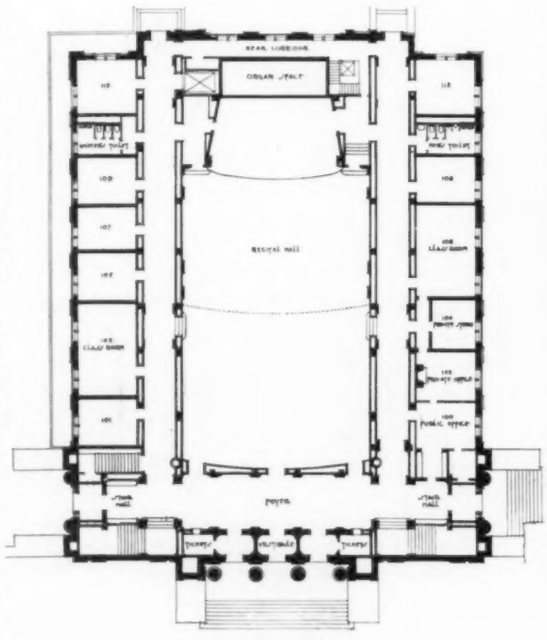
By F. R. WATSON, *Professor of Experimental Physics, University of Illinois*

THE Smith Memorial Music Building was built to accommodate the School of Music at the University of Illinois. It is a reinforced concrete structure, containing two stories with an attic space and basement. The total floor area is 65,641 square feet, and the volume 1,146,812 cubic feet. For the purposes of instruction in music, a number of special features were needed, such as practice rooms for students, studios for instructors, and a concert hall for recitals. In view of the varied nature of the music and the likelihood of discord, it was especially desired that the different rooms be separated by soundproofing. It was also of importance that the concert hall be designed acoustically so that music could be rendered under the most favorable conditions.

In view of these demands, and also because of a personal interest in the matter, a collaborative investigation of the problem was conducted by the architects and the writer. An effort was made to soundproof the building throughout. This involved the insulation of 45 small practice rooms in the attic, 21 studios and classrooms on the first and second floors, and the large concert hall. An effort was also made to reduce noises due to fans, motors and elevators. The various systems of steam pipes, electric conduits and ventilation ducts were installed in special ways to minimize the possibility of their transmitting sound. The building has been in use for several months, so that a statement may now be made concerning the outcome of the venture. While the essential objects sought for appear to have been attained with a fair degree of success, this account is written to set forth the features of the construction and to discuss their effects, advantageous or otherwise, in controlling sound.

Before describing the acoustic details, it appears desirable to give some account of the action of sound in a building and thus make apparent the reasons for adopting the various methods of construction.

ACTION OF SOUNDWAVES IN A BUILDING. Sound consists of a series of pressure pulses that travel through the air or in the solid structure of a building. Two types of sound should be considered. The first type includes sounds that are generated in the air by a violin, the human voice, etc., which travel through the air to the boundaries of the room. Such sounds are reflected to a marked degree by continuous walls of some rigidity. Where an air passage is presented, however, such as a ventilation pipe or an open window or door, the sound waves pass readily on through until they meet some solid obstruction. If the air passages from a room are suitably guarded, the sound may be confined to the room and absorbed by rugs, furniture and walls. The second type of sound originates in the vibrations from a piano, cello or other instrument that comes into intimate contact with the building structure. These vibrations proceed readily through the continuity of structure to all parts of a building, setting up air vibrations (sound) whenever a wall or other construction member responds markedly to the traveling vibrations. To stop these waves, it is necessary to interpose in their path a substance or construction having a decided change in elasticity or density. An air space in masonry construction would be a very efficient obstacle, provided the air space were continuous and not bridged over by any solid structure. Since this is practically impossible in buildings with any degree of rigidity, recourse must be had to special devices such as soundproof partitions and floating floors that interpose layers of hair felt or other air-filled material. If the vibrations can be made to pass from solid structure into the air, they may be absorbed largely by felt or similar material. With these considerations in mind, the efficiency of the various constructions is more readily understood.

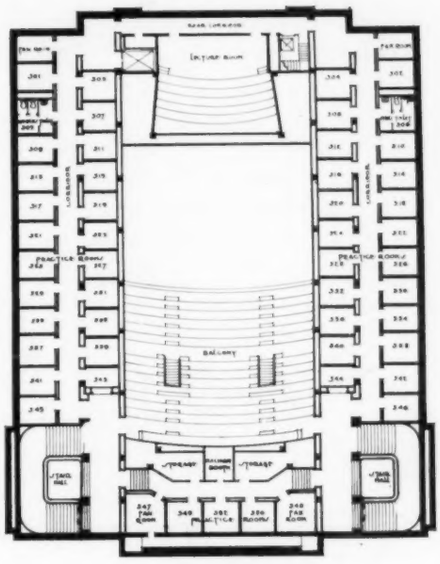


First Floor Plan

DETAILS OF CONSTRUCTION. The framework of the Smith Memorial Music Building is constructed of reinforced concrete with combination tile and concrete joist floor construction, thus giving a massive, rigid structure not easily affected by vibrations. The soundproofing of rooms involved an application of the principles set forth in

the previous paragraphs but in conformity with the restrictions imposed by practical building requirements. Each room was treated as a unit and was insulated at the floor, ceiling and walls, except outside walls.

PARTITIONS. The partitions between rooms are constructed of two 3-inch gypsum block members separated by a 2-inch air space that contains a layer of sound-absorbing material. The method of construction was interesting. First, one 3-inch member was built up complete. Wood strips were nailed to this and the layer of patent sound-absorber was tacked to the wood strips so as to leave no open joints. Then the second member was built, attention being paid in the construction to prevent contact between the gypsum blocks or the mortar at the joints with the sound-absorber on the first member. Both of these 3-inch members rest on machinery cork, thus breaking the intimate plaster contact with the floor construction. They are insulated from the floor above by hair felt. At the outside walls the partitions project into a 4-inch chase insulated by hair felt, thus guarding against possible crack openings. Contact between the partitions and columns, beams, etc., is avoided by the interposition of hair felt. This arrangement places the patent sound-absorber or hair felt as an obstacle to transmission of sound, particularly if cracks or openings develop in the partitions.



Attic Plan

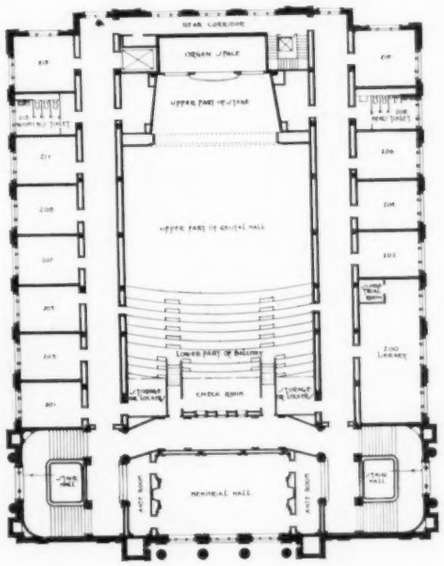
FLOOR CONSTRUCTION. The structural floors are composed of reinforced concrete 12 inches thick with 10-inch hollow tile inserted to reduce the weight. Wooden planks were set in place so as to make a structural break under each room partition. This arrangement assists in making each room an insulated unit.

From the structural floor up, the details of construction are: a 1-inch layer of dry sand, 2 inches of cinder concrete fill with cement topping, a layer of uncoated builder's felt, and finally linoleum. The sand serves to break the continuity of the structure between the finished floor and the structural floor.

CEILINGS. Suspended ceilings of metal lath and plaster are installed in the practice rooms on the third floor. While these ceilings are thin, compared with the walls, it is assumed that any sound transmitted through them will be absorbed to a considerable extent in the attic space and will have to pass through a second ceiling before reaching the interior of another room. Double windows in the ceilings allow light to enter from skylights. The ceilings of the studios on the lower floors consist of two coats of plaster on the underside of the structural floor. These will be covered with sound-absorbing material, where it is found desirable, to reduce the reverberation in the room.

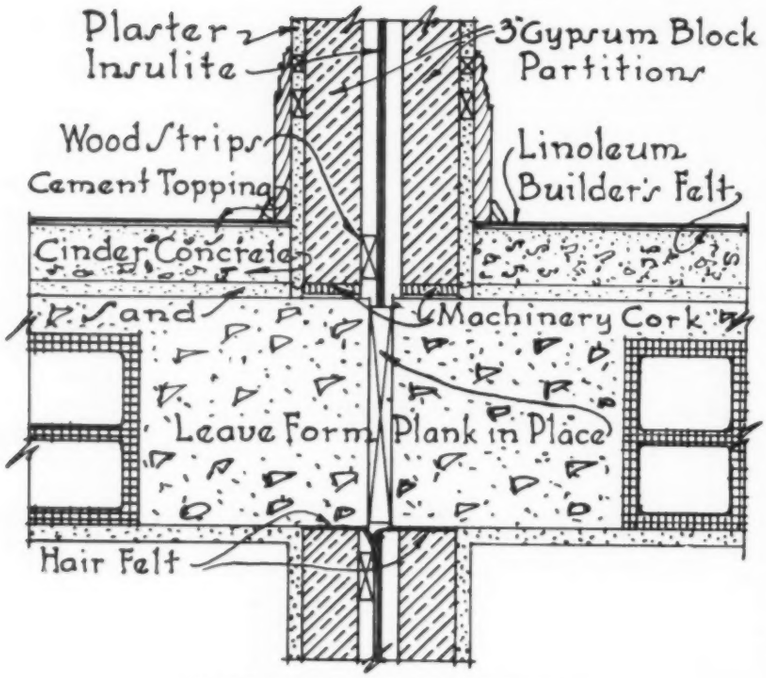
DOORS, TRANSOMS AND WINDOWS. All studios and practice rooms are equipped with a special soundproof door of heavy double construction with a 1-inch thickness of hair felt in the center. It makes a tight closure all around against felt stops and, by means of a lever door handle, presses a felt stop down so as to close the threshold crack.

An accompanying diagram shows the construction of the frames for the soundproof doors and transoms. The woodwork is backed with heavy felt to avoid direct openings through which sound might pass behind the finished jambs from the room to the corridor outside. All transoms are fixed and are set in rabbets 1 inch deep, being pushed tightly against a heavy, tubular wool felt. This felt is held in place with removable wedge-shaped strips so that it may be replaced with new felt when desired. The transoms are double-glazed, with the glass panes set in felt. The double windows in the ceilings of practice rooms are insulated in much the same manner.



Second Floor Plan

PIPES FOR LIGHTING AND HEATING. A special study was made of the placing of pipes to avoid possibility of easy transfer of sound. Electrical wire conduits are carried in vertical shafts in outside or corridor walls,



Detail Showing Floor and Partition Construction

with wall plug outlets in each room. This obviates making outlets in the ceilings and floors, according to usual practice, and reduces the leakage of sound. Steam pipes for heating are housed in chases in the brick walls, the chases being filled with sponge felt to prevent transmission of sound vertically. The steam radiators are bracketed from the outside walls and do not touch the floor, thus lessening the chance that floor vibrations from pianos will enter the metal heating system. Attic rooms are heated by warm air and therefore are not connected with the steam heating system.

THE VENTILATION SYSTEM. There are four separate ventilation systems that furnish washed, fresh air to the various rooms in the building. It is therefore unnecessary to open windows for fresh air, and the escape of sound through these open vents is made impossible. Having four systems lessens the chance of transmission of sound between different parts of the building. One system supplies the studios and classrooms on the first and second floors. A separate supply duct leads from the main duct to each room. A second system ventilates the concert hall. The practice rooms in the attic are arranged in two groups, each group being supplied with air from a separate system, which serves also for heating. Individual outlet ducts convey used air from each room to the upper attic space, where it leaves the building.

CORRIDORS AND HALLS. The floors of the passageways in the building are covered with cork or linoleum to deaden the sound of footsteps. Swinging doors are installed in several places to minimize transfer of sound through the halls. The two elevator shafts are situated apart from music rooms and housed inside tile walls to avoid easy transfer of sound. Elevator doors are arranged to shut tightly. Ventilating fans are of slow velocity type to decrease noise, and are installed in special rooms.

SUMMARY OF CONSTRUCTION DETAILS. It was the intention to insulate each room as far as possible to make it a separate unit. Since the greatest chance for leakage of sound appeared to be through the walls separating adjacent rooms, all such walls, floors and ceilings were left continuous without any breaks in the surface. Where it was necessary to have openings, these were placed in other walls. Ventilators and doors were located in the partitions facing the corridors. Electrical conduit and steam pipes were housed in outside or corridor walls. Windows were placed in doors or outside walls. This arrangement minimized the likelihood of sound transference directly from one room to another. Furthermore, any sound leaking through the openings for doors, windows, etc., would have to pass along a corridor and penetrate a second barrier to reach the interior of another room.

THE CONCERT HALL. The concert hall is situated in the center of the building and is insulated from studios by surrounding corridors on the first and second floors. Practice rooms on the third floor are contiguous to two walls. Further insulation is provided by double walls consisting of two 4-inch hollow tile members separated by a 17-inch air space. These side walls are continuous to the roof, thus leaving no openings, except for tight closing doors, through which sound may pass.

A special study was made of the acoustical design of this hall. Since it was designed solely for music, the time of reverberation should be greater than for speaking. Accordingly, only a moderate amount of sound-absorbing material was prescribed, in accordance with Sabine's formula, and a considerable percentage of this absorption was secured by using upholstered seats. Ventilation grilles break the expanse of the ceiling surface. Two large panels in the side walls are to be covered with felt and a decorative tapestry cover.

The acoustic properties of this room are in accord with the expectations. Music of moderate intensity, such as chamber music or vocal solos, is rendered in a pleasing way. Musicians say that it is easy to sing in the room. The tones flow easily and with little effort. Heavy orchestras would be heard at a disadvantage, because the intensity would be too great. Speaking is also done at a disadvantage, because of the rather long period of reverberation. With a considerable audience present, the conditions for speaking are improved,

while the music is still heard advantageously. Director Erb, of the School of Music, reports that the hall is "perfect" for music. Arthur Beresford, whose experience as a baritone has given him a wide acquaintance with music halls, says that the "recital hall is the best in the country."

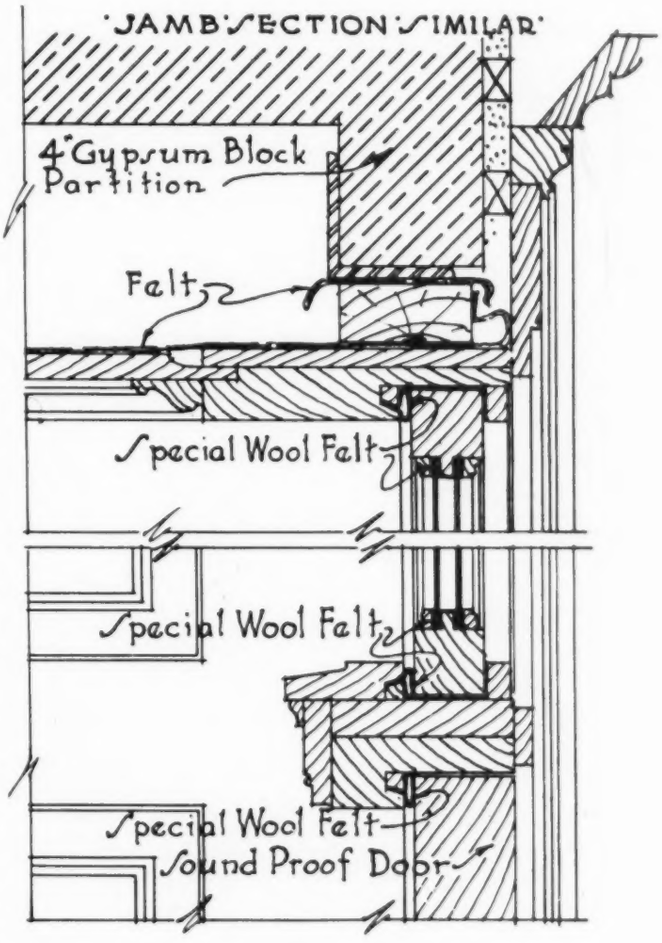
EXPERIMENTAL INVESTIGATIONS. Tests have been made of the efficiency of the soundproofing. One observer, inside a practice room with the door shut and speaking in a loud voice, can scarcely be heard by a second observer outside in the corridor. Music, however, penetrates the walls more easily, although it is greatly diminished in the transmission. Students in practice rooms say that they notice sounds from other rooms only when they stop practicing. The partitions are thus not absolutely soundproof but, for practical purposes, it appears that they need not be. The walls could have been made more effective but the construction would have been elaborate and costly and not in accordance with ordinary building requirements.

One of the severest tests given the partitions is by a small practice pipe organ in a studio on the first floor. When this organ is played, sound is transmitted to adjacent rooms. The double partition vibrates under the vigorous action of the sound waves. An observer in an adjacent room, by placing his ear or fingers against the partition, can hear or feel the varying pulses in different degrees, depending on the pitch of the tone and its intensity. He can also feel the vibrations in the floor. This transmitted sound, however, becomes of minor importance when a piano is played in the room.

Another test of the efficiency of the partitions was discovered accidentally. During an investigation, a sound of undue intensity could be heard in the halls of the building and in some of the studios. The sound was located readily in an unsuspected room on the third floor over the organ loft. Since this room was designed for lectures, it was not soundproofed as for music rooms. A piano placed temporarily in this room for practice purposes gave rise to sounds that quite easily penetrated the partitions and thus gave direct evidence of the desirability of double partitions. Sound also passed through the ventilators from this room to studios. Considerable sound could be heard in the hallways. This was to be expected, as already explained, by leakage of sound through doors, ventilator frames and other breaks which were purposely placed in the corridor partitions rather than in walls separating rooms. This confusion of sounds in the halls is not particularly objectionable, but it would probably be better if carpets were used or else sound-absorbing materials placed on corridor ceilings.

The concert hall is insulated by double walls and surrounded by corridors, except for practice rooms on the third floor. This arrangement appears to be effective. But little sound is transmitted from other parts of the building. The writer sat near the wall adjacent to the practice rooms and could detect faint sounds, but these appeared unimportant compared with music generated in the concert hall itself. Piano music in the third floor lecture room had easy access through ceiling ventilators and was objectionable.

The ventilation ducts allow a transfer of sound between different rooms in greater amount than the partitions. The use of separate ducts for each room minimizes the trouble, but greater insulation is to be desired. Ventilator stops with layers of sound padding have been tried with some effect, but further modifications are contemplated to reduce this leakage. One marked case of the transfer of sound by ventilation ducts was discovered between the lecture room on the third floor and a studio on the first floor. An inspection of the ventilating system revealed the reason. The outlets to the lecture room were of rather large area and left the main duct opposite the outlet to the studio. As a result, sound originating in either room traveled to the main duct, crossed it and entered the opposite duct where it proceeded readily to the other room. Except for this lecture room, the individual pipes lead-



Section through Door Head and Transom Bar

Note double glass in transom and special closing door on tubular felt strips

ing to studios proceed from the same side of the main duct with a lessened chance for intercommunication of sound.

The soundproof doors have not been entirely satisfactory. The success of the insulation depends on closing the door tightly, and this requires a considerable pressure on the patent door handle. People using the rooms do not always observe this requirement so that an aperture is left for the escape of sound. Possibly a door with an automatic closing device would prevent this trouble. A door is analogous to a single partition. Sound transmitted through a door to the corridor must pass through another door or wall to get into a second room.

CONCLUSIONS. The installation of special forms of construction in the building appears to have a decided effect in controlling and diminishing sound, although the effects are uneven. The building is not absolutely soundproof and the experience thus far indicates that it is not essential that it should be. Each room was insulated as thoroughly as possible; motors, fans and other machinery were selected from types that produced little noise; elevators were placed in separate housings.

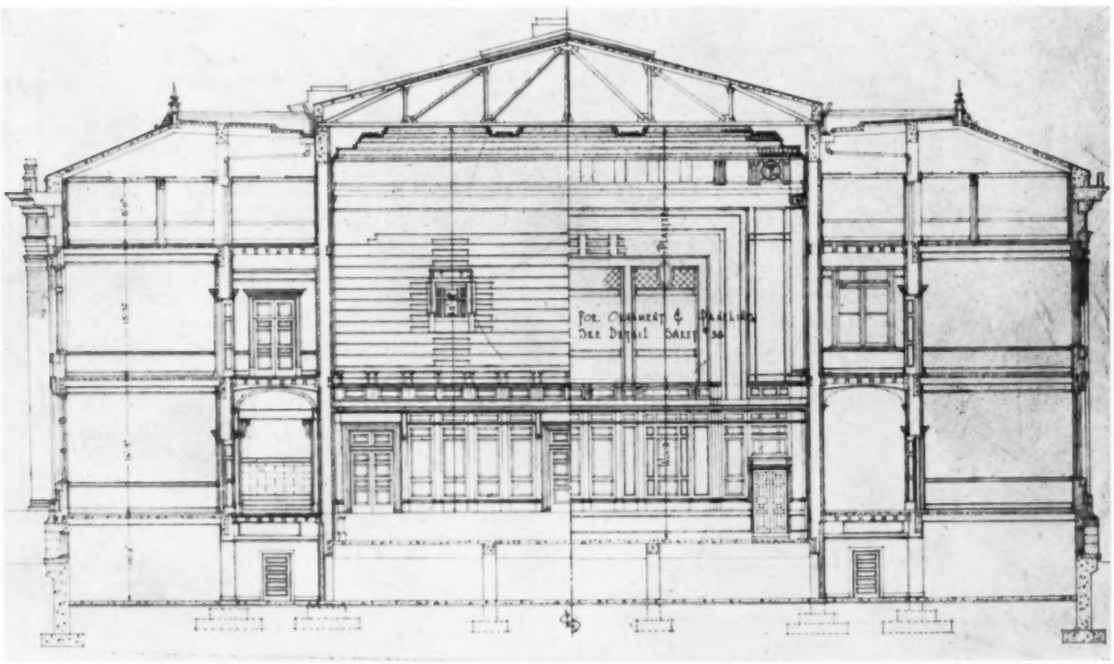
Sound travels easily through the continuity of building materials and its paths are not easily traced. With each room insulated, it is difficult for a generated sound to penetrate the insulation and a similar obstacle exists to its entrance into another room. In the meantime, while traversing the building structure, such a sound continually meets obstacles in its progress that reflect and absorb it until its energy is dissipated.

It is not easy experimentally to estimate with any great accuracy the separate effects of the various sound-insulating constructions. A person in a room can hear diminished musical sounds, but is unable to give confidently, in each case, the source of the leakage. The experiments show, directly and indirectly, the advantage of using continuous, unbroken walls, floors and ceilings between adjacent rooms. Making these walls double, with air spaces containing sound-absorbing material, adds to their efficiency.* Placing the necessary openings for doors, windows and ventilators in outside or corridor walls confines the leakage of sound largely to corridors, with a reduced possibility of transfer of sound between rooms.

Ventilation ducts, even with separate pipes to each room, do not appear to insulate sound as completely as double walls. Using separate ventilation systems for groups of rooms reduces the possibilities for transfer of sound between different parts of the building. Further investigation is desired to develop a more effective soundproof ventilation.

The concert hall, designed in accordance with the known facts of acoustics of auditoriums, possesses properties that assist in an acceptable manner in the pleasing production of music. Without commenting in further detail on the arrangement of pipes, doors, windows, etc., it may be said that the experiments in this building show some of the features necessary for effective control of sound, and that while there is much more to be learned, enough has been discovered to lend support to the belief that soundproofing in buildings may be prescribed in the not distant future with some of the certainty that now attends the acoustic design of auditoriums.

*The plaster partition members of these double walls should possess, as far as possible, the desirable qualities of mass, rigidity and freedom from vibration as described in THE ARCHITECTURAL FORUM for June, 1920



Transverse Section through Recital Hall, Half Showing Stage and Half Balcony End

ENGINEERING DEPARTMENT

Charles A. Whittemore, *Associate Editor*

Steel Design for Buildings

PART IV. DESIGN OF COLUMN BASES AND FOOTINGS

By CHARLES L. SHEDD, C.E.

IN the June number of THE FORUM we took up the general consideration of the design of column bases. Figs. 17 and 18 showed two types of bases for a plate and angle column carrying loads of about 500,000 pounds.

Let us now consider the actual design of a concrete example. Let us take a load of 668,000 pounds with a column unsupported for a length of 17′ 6″. Using the column formula of 16,000—70 l/r we find that we can use a column made up thus: four 6″ x 4″ x ¾″ Ls, one 12″ x ¾″ web plate and two 14″ x ¾″ cover plates. This column has a radius of gyration of 3.25 about its weaker axis, which gives an l/r of 64.3 which in turn, with the formula just expressed, gives an allowable stress of 11,500 pounds per square inch which is about equal to the actual stress on this column with the load used. If this column base is to bear on concrete and we use an allowable bearing of 700 pounds per square inch, we get a required area of 955 square inches which requires a base at least 31″ square. If we use a steel base, as shown in Fig. 17, let us use a base plate 32″ x 32″ to make even figures. If we allow the plate itself to transfer the load a short distance out from the face of the column we can take the part which must be taken by the stiffeners as 7/32 of 668,000 or 146,000 pounds. If we use ¾″ rivets, worth 4420 pounds each in single shear, we would require 33 rivets. As we are to use four rows of rivets we will use 36 rivets, or 9 in each row as shown in Fig. 1. As these stiffeners are short we can use 16,000 pounds per square inch on them in compression which will allow us to use 6″ x 6″ x ½″ Ls. We can use the same size for the long base angles and ½″ for the thickness of the gusset. The base plate should be ¾″ thick and the short base angles could be 4″ x 4″ x ⅜″ Ls. In the small bases

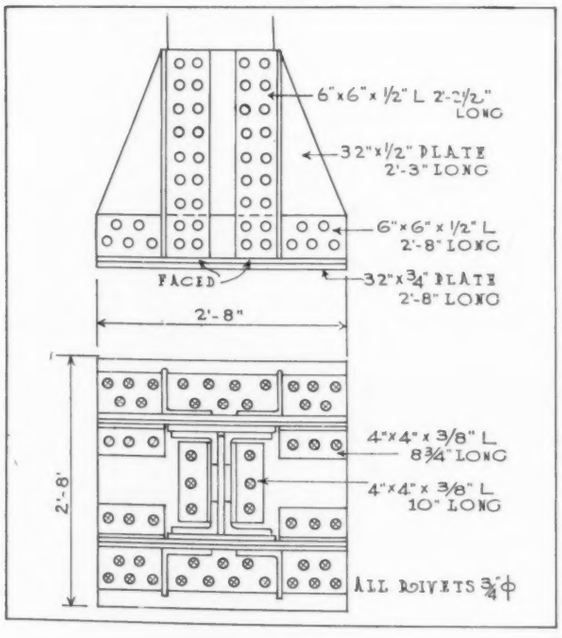


Fig. 1

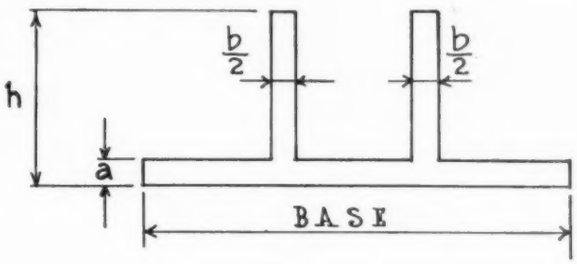


Fig. 2

shown in Figs. 14, 15 and 16 in the June FORUM the same principles apply, but probably the only thing that would be necessary to figure would be the area of the base. The number of rivets required in Fig. 16 might be a limiting factor.

If we use a cast iron base as indicated in Fig. 18 in the June number, we have a section through its center consisting of the base with two or three uprights (Fig. 2). The small projections at the top may be neglected. It is this section which resists the bending on the base. With a plate and angle column the maximum bending is at right angles to the web of the column as the distance of the center of gravity of half the column from the center of the base is less than in the other direction. To facilitate the designing of these cast iron columns a table has been prepared of the sectional moduli of various sections. Various widths of base have been used, 20″, 24″, 28″, 30″ and 36″, with various heights for each size of base; "a" is the thickness of the base and "b" is the combined thickness of the ribs. The

20″ BASES

10″ High

a	b=2″	2½″	3″	3½″
1″	126	134	140	146
1¼	139	147	155	161
1½	148	157	166	171
1¾	155	165	173	182

12″ High

a	b=2″	2½″	3″	3½″
1″	165	175	185	194
1¼	184	196	205	214
1½	200	211	222	232
1¾	212	224	236	246

14″ High

a	b=2″	2½″	3″	3½″
1″	206	221	234	247
1¼	233	246	260	272
1½	254	269	282	295
1¾	272	288	302	315

15″ High

a	b=2″	2½″	3″	3½″
1″	229	245	259	275
1¼	258	274	288	303
1½	282	299	314	328
1¾	303	320	336	351

24″ BASES

10″ High

a	b=2″	2½″	3″	3½″
1″	144	151	159	165
1¼	159	168	176	183
1½	168	180	188	196
1¾	175	186	197	206

12″ High

a	b=2″	2½″	3″	3½″
1″	190	200	210	220
1¼	212	223	234	244
1½	229	241	254	264
1¾	241	257	269	282

14″ High

a	b=2″	2½″	3″	3½″
1″	237	251	265	279
1¼	266	283	296	309
1½	291	308	323	336
1¾	312	329	343	360

15″ High

a	b=2″	2½″	3″	3½″
1″	261	278	294	309
1¼	295	312	328	343
1½	324	342	358	374
1¾	348	367	385	401

28″ BASES

12″ High

a	b=2″	2½″	3″	3½″	4″
1″	212	224	235	245	254
1¼	238	251	262	273	283
1½	256	272	285	295	306
1¾	271	287	302	314	325

14″ High

a	b=2″	2½″	3″	3½″	4″
1″	265	281	294	309	322
1¼	303	317	332	345	359
1½	327	346	362	376	390
1¾	349	370	388	402	415

15″ High

a	b=2″	2½″	3″	3½″	4″
1″	293	311	327	342	358
1¼	333	351	367	383	398
1½	364	384	402	418	433
1¾	390	414	432	449	466

18″ High

a	b=2″	2½″	3″	3½″	4″
1″	380	404	427	451	473
1¼	431	457	481	503	526
1½	478	505	528	552	575
1¾	518	547	572	596	618

30″ BASES

12″ High

a	b=2″	2½″	3″	3½″	4″
1″	224	236	247	258	267
1¼	251	264	276	287	297
1½	269	286	299	311	323
1¾	283	301	317	330	344
2	290	313	330	344	358

14″ High

a	b=2″	2½″	3″	3½″	4″
1″	280	296	311	324	337
1¼	316	334	349	363	377
1½	346	364	380	396	411
1¾	367	390	407	424	439
2	383	408	429	447	461

15″ High

a	b=2″	2½″	3″	3½″	4″
1″	309	326	344	360	374
1¼	350	370	387	404	418
1½	384	404	423	440	456
1¾	410	433	457	472	489
2	431	458	479	500	517

18″ High

a	b=2″	2½″	3″	3½″	4″
1″	399	424	447	476	493
1¼	456	482	505	528	549
1½	505	532	555	579	602
1¾	546	576	602	626	649
2	578	612	640	666	689

36″ BASES

12″ High

a	b=2½″	3″	3½″	4″	4½″	5″
1¼″	304	318	331	342	352	361
1½	327	343	357	369	380	390
1¾	344	362	378	392	404	415
2	355	375	393	409	422	434
2¼	359	383	404	421	435	448
2½	361	387	408	427	444	461

14″ High

a	b=2½″	3″	3½″	4″	4½″	5″
1¼″	383	400	416	431	445	458
1½	417	437	455	470	484	499
1¾	446	467	486	503	517	533
2	465	490	514	530	546	561
2¼	477	506	530	551	569	584
2½	488	516	544	566	585	604

15″ High

a	b=2½″	3″	3½″	4″	4½″	5″
1¼″	425	442	459	476	491	507
1½	466	486	505	522	539	553
1¾	498	521	541	561	576	594
2	523	550	573	591	611	630
2¼	542	571	596	619	639	656
2½	553	585	614	638	660	676

18″ High

a	b=2½″	3″	3½″	4″	4½″	5″
1¼″	553	578	602	626	647	669
1½	612	640	664	688	711	735
1¾	661	691	719	745	767	787
2	703	735	765	790	814	840
2¼	735	774	804	832	859	882
2½	762	801	836	868	895	921

SECTIONAL MODULI OF CAST IRON BASES

figure in the body of the table is the sectional modulus.

As 31″ is required we will use the next larger in the tables, that is 36″. The moment will be equal to half the load on the column multiplied by a quarter the width of the base, less the distance from the center of the base to the center of gravity of half the column, in this case 334,000 (9–2.38), and this divided by the allowable tension on cast iron (3,500 is used here) gives the required sectional modulus. Looking up this quantity (630) in the portion of the table for 36″ bases we find various sections which we may pick from:

h	a	b	h	a	b
15″	2½″	4″	18″	1¾″	2½″
15″	2¼″	4½″	18″	1½″	3″
15″	2″	5″	18″	1¼″	4½″

It is best to have the thickness of the cast iron directly below the column at least as thick as the column metal itself. This might necessitate thicker metal in some cases than would be required for the sectional modulus. The ideal base, of course, is the one which will fulfill all the conditions we have noted and be of least weight. One of the most important conditions to remember, as noted in the June FORUM, is to keep the thicknesses of metal as nearly equal as possible. To do this it is usually best to choose a base where "b" is about twice "a." The local bending between ribs is also an important consideration. In a column as large as the one we are designing for, this thickness of the base should not be too small and it would be safer to choose the first than the second section of these we have found possible in the table. This means that we can use a base 15″ high with the base 2½″ thick (Fig. 3). The two ribs under the flanges of the column should equal "b" or 4″, so we can make them 2″ each as the steel above is only 1½″ thick. The steel in the web of the column is 2¼″ thick, therefore we should make the middle web of the base 2¼″ thick. The two side ribs parallel to it could be made 1″ each, using the minimum thickness as the two side ribs plus the middle rib would then equal 4¼″, which is more than the required value of "b." The corner

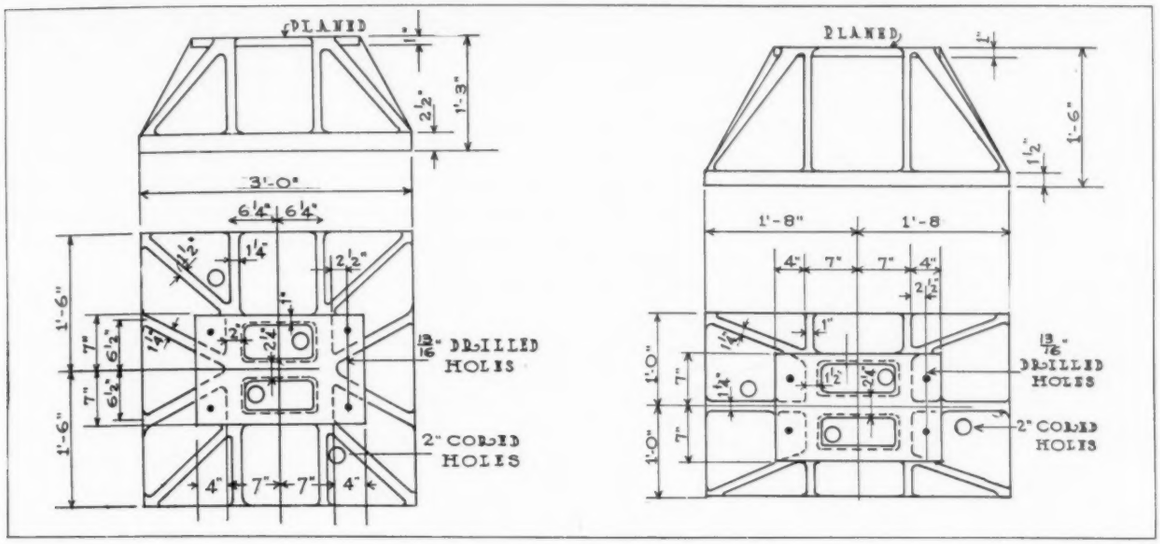


Fig. 3

Fig. 4

ribs could be made 1½″ and the other outside ribs 1¼″. The top plate should be the minimum thickness, that is 1″, and should project 4″ beyond the ribs under the column flanges to allow the bolts connecting the base to the column to be easily placed in position. In larger bases, where cast steel is employed, 16,000 could be used as the allowable fiber stress in place of 3,500. Other sizes of bases can be readily used besides those given in the table by proportion, as will be shown.

If we multiply both the width of base and "b" by any factor we are also multiplying the sectional modulus by that same factor. If we multiply the height and "a" by a factor we are multiplying the sectional modulus by the square of that factor. For example, referring to the table we may find these values:

Base	h	a	b	I/y
20″	12″	1½″	2″	200
30″	12″	1½″	3″	299

and the values:

Base	h	a	b	I/y
36″	12″	1½″	2½″	327
36″	18″	2¼″	2½″	735

where it will be noted that 327 x 1.5 x 1.5 = 735.

From this relation we may use the tables for an endless number of base designs. For example, we may design the base which we have already designed for one just 32″ square, by using the 36″ table. 36/32 = 1.12. The required sectional modulus would be $\frac{334{,}000(8-2.38)}{3{,}500} = 540$. 540 x 1.12 = 600. Looking this up in the 36″ table we find:

h = 18″ a = 1¼″ b = 3½″ I/y = 602.

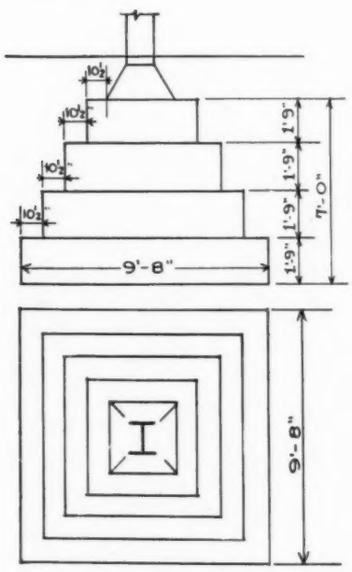


Fig. 5

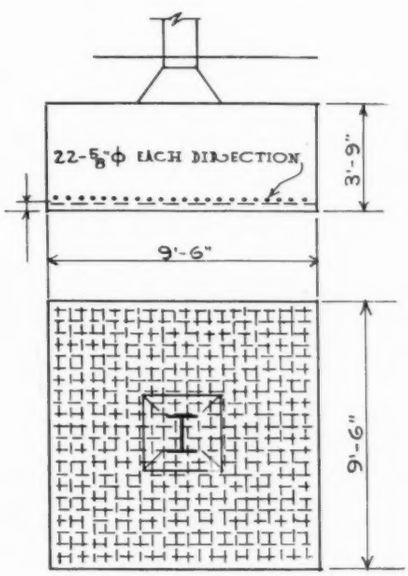


Fig. 6

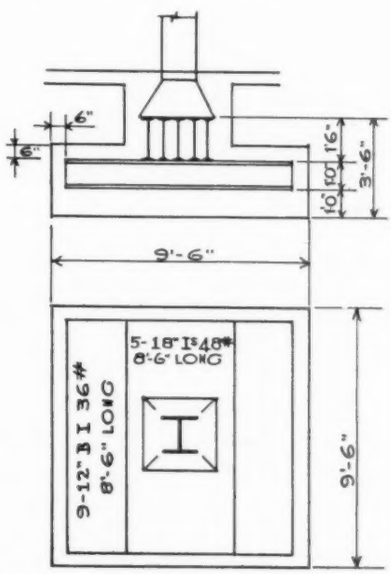


Fig. 7

$3\frac{1}{2}''$ divided by 1.12 would equal 3.13 and we could use a base

Base = 32″ h = 18″ a = $1\frac{1}{4}''$ b = $3\frac{1}{4}''$.

Places are at times encountered in a building where it is desirable to use an oblong base. These tables may still be used with the aid of these rules.

The column for which we have already designed three bases may be used again for an oblong base. The area required was 955 square inches. If we had to have this base 24″ wide it would have to be 40″ long (Fig. 4). If the web of the column is parallel to the long side of the base an economical base may be designed. The distance from the center of the column to the center of gravity of half of the column, measured parallel to the web, is 5.36. The moment in this direction would then be 334,000(10 − 5.36) and the required sectional modulus would be 443. For this we find for a 24″ base h = 18″ a = $1\frac{1}{2}''$ b = $2\frac{1}{2}''$. The moment in the opposite direction would be 334,000(6 − 2.38) and the required sectional modulus 345. For a 40″ base with h = 18″ and a = $1\frac{1}{2}''$ the value of "b" could be a minimum or 2″.

Under the column base the footing may be made of concrete or a combination of concrete and steel. Such a combination may be reinforced concrete or grillage beams encased in concrete, or a combination of grillage with concrete below it, either plain or reinforced.

If the footing is plain concrete (Fig. 5) not reinforced the footing may be assumed to weigh about 10% of the column load, or in this case 66,800 pounds, which would make a total load on the soil equal to 734,800 pounds. If we had soil capable of carrying 8,000 pounds per square foot we should require a footing of 92 square feet or 9′ 8″ square. In plain concrete, steps are usually made about 2′ high and 1′ wide. With a 32″ column base this would require a footing 7′ 0″ deep.

If the column footing were made of reinforced concrete (Fig. 6) the footing could be most easily designed from tables found in Hool and Whitney's "Concrete Designers' Manual." Here we find that the reinforced footing would be 9′ 6″ square, 3′ 9″ deep with 17 square $\frac{5}{8}''$ or 22 round $\frac{5}{8}''$ rods in each direction.

If we used grillage (Fig. 7) we could design it readily from Table I in the July FORUM. We will use a footing 9′ 6″ square which will project 3′ 5″ each side of the base. The grillage can be made of several I beams side by side under the base extending to within 6″ of the outside of the footing, with another layer of I beams under them and at right angles to them and of the same length. The bending on each layer would be 334,000 (2.92 − 1.33) = 530,000 foot-pounds. The shear on each layer would be $668{,}000 \frac{3.42}{9.50} = 240{,}000$ pounds.

To design these beams it is a simple matter to make a table for the investigation of each footing. First find the actual buckling per lineal inch for various depths of beam. This will be equal to the column load divided by the width of base plus half the depth of the beams. Thus:

12″ Beams	668,000/38	= 17,600
15″	39.5	= 16,900
18″	41	= 16,300
20″	42	= 15,900

We can now make a table showing the required moment, shear and buckling per beam for various numbers of beams. Thus:

			Buckling			
No.	Mom.	Shear	12″	15″	18″	20″
9	59,0	26,7	2,0	1,9	1,9	1,8
8	66,3	30,0	2,2	2,2	2,1	2,0
7	75,7	34,4	2,5	2,5	2,4	2,3
6	88,5	40,0	3,0	2,9	2,8	2,7
5	106,0	48,1	3,6	3,4	3,3	3,2
4	132,5	60,1	4,4	4,3	4,1	4,0
3	176,8	80,2	5,9	5,7	5,5	5,3

To find the most economical beam for each case we can use Table I in the July FORUM and follow down the column of moments until we find a moment of resistance large enough, then see if the shear and buckling are all right. If they are not, follow down still farther in the table and the first one found which will satisfy all three requirements is the most economical for that number of beams. Thus if we have four beams, with a moment on each of 176,800, we find that the first one is the 20″ BI 59# and that the shear is also sufficient, but the buckling is only good for 3,700 while we require for a 20″ beam 4,000. Following on still farther, the first one reached which satisfies all conditions is the 21″ I $60\frac{1}{2}$#. The flange width may be another limiting factor. There should be at least an inch between flanges to allow for proper filling with concrete. In the table given here we will show the size of beam required, the combined flange width for each group allowing 1″ between each flange, and the weight per lineal foot of each group for comparison:

No.	Section	Flange	Weight
9	12″ BI 36#	64.7	324
8	15″ I $37\frac{1}{2}$#	51.0	300
7	15″ BI 38#	52.2	266
6	18″ I 48#	41.0	288
5	18″ I 48#	34.0	240
4	21″ I $60\frac{1}{2}$#	29.0	242
3	20″ I 80#	23.0	240

Evidently the six-beam grillage would not be best for any case. The four-beam would likewise never be chosen. With a 32″ column base we could use either the five- or the three-beam for the top course. The weight would be the same and the flange width would be satisfactory, as in the five-beam design the flanges would only project an inch on each side of the base, leaving the webs well under the base. As these beams are 2″ less in depth than the three-beam we will use these to save that much excavation. In the bottom course we have 6′ 9″ less 1 foot of concrete, as the allowable flange width which would be 102″. Thus any of the designs could be used here. If the beams are a foot apart the stress can be distributed satisfactorily to the concrete below. We will therefore use nine beams for the lower course. This makes the footing 3′ 6″ deep which is 3″ less than for reinforced concrete.

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Testing Materials

By HERBERT L. SHERMAN, B.S., of Skinner, Sherman & Esselen, Inc., Chemists and Engineers

IT is in order to assure the use of only entirely satisfactory materials that architects and engineers so universally call for tests or inspections.

About 25 or 30 years ago the larger consumers of cement began to install testing laboratories. Those were hard days for the cement manufacturer. Not only was his product less uniform than today and the justified number of rejections greater, but he had to contend with tests made by entirely unqualified testers who knew little if anything about the action or use of cement. It was always "up to the manufacturer" to prove himself innocent, and often it meant great expenditure of time and money.

It was also customary, not so many years ago, for each engineer or architect to write his own specifications and they were, indeed, a varied lot. If the manufacturer did not supply a product which would pass each requirement of each consumer, he was likely to be ordered to remove the cement from the site. It was an impossible situation. However, the great bulk of cement used was not tested and it speaks well for the industry in its infancy that so many fine pieces of work are standing in such excellent condition.

Until a few years ago, testing was nearly always done on samples taken from the job. This meant that considerable storage space was necessary for a large piece of work as, even from the start, it has been unsafe to pass any conclusive opinion until seven-day tests are completed. In recent years, however, it has become more customary to test the cement at the point of shipment, a representative of the testing laboratory taking samples from each car as it is loaded.

The American Society for Testing Materials has done more than any other body to advance the cause of cement testing and, in fact, the testing and inspection of materials in general. Large committees representing both consumers and manufacturers have worked for years on the preparation of standardized specifications which shall be fair to all, and their work has been wonderful.

All the architect or engineer has to do today is to include a sentence in his specifications under "Cement" that "All Portland cement used shall meet the requirements of the American Society for Testing Materials." Every manufacturer agrees, without the necessity of a special clause, to produce a material which is satisfactory under these specifications. The requirements are thus given:

Standard Specifications and Tests for Portland Cement

Serial Designation: C9—21

Adopted, 1904: Revised 1908, 1909, 1916, 1920 (Effective Jan. 1, 1921)

These specifications were approved January 15, 1921, as "Tentative American Standard" by the American Engineering Standards Committee.

Specifications

1. Portland cement is the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination excepting water and calcined or uncalcined gypsum.

I. Chemical Properties

2. The following limits shall not be exceeded:

Loss on ignition, per cent	4.00
Insoluble residue, per cent	0.85
Sulphuric anhydride (SO_3) per cent	2.00
Magnesia (MgO) per cent	5.00

II. Physical Properties

3. The specific gravity of cement shall be not less than 3.10 (3.07 for white Portland cement). Should the test of cement as received fall below this requirement, a second test may be made upon an ignited sample. The specific gravity test will not be made unless specifically ordered.

4. For fineness, the residue on a standard No. 200 sieve shall not exceed 22 per cent by weight.

5. A pat of neat cement shall remain firm and hard, and show no signs of distortion, cracking, checking or disintegration in the steam test for soundness.

6. The cement shall not develop initial set in less than 45 minutes when the Vicat needle is used, or 60 minutes when the Gillmore needle is used. Final set shall be attained within 10 hours.

7. The average tensile strength in pounds per square inch of not less than three standard mortar briquettes (see Section 50) composed of one part cement and three parts standard sand, by weight, shall be equal to or higher than the following:

Age of Test, days	Storage of Briquettes	Tensile Strength lbs. per sq. ft.
7	1 day in moist air, 6 days in water	200
28	1 day in moist air, 27 days in water	300

8. The average tensile strength of standard mortar at 28 days shall be higher than the strength at 7 days.

III. Packages, Marking and Storage

9. The cement shall be delivered in suitable bags or barrels with the brand and name of the manufacturer plainly marked thereon, unless shipped in bulk. A bag shall contain 94 lbs. net. A barrel shall contain 376 lbs. net.

10. The cement shall be stored in such a manner as to permit easy access for proper inspection and identification of each shipment, and in a suitable weather-tight building which will protect the cement from dampness.

IV. Inspection

11. Every facility shall be provided the purchaser for careful sampling and inspection at either the mill or at the site of the work, as may be specified by the purchaser. At least 10 days from the time of sampling shall be allowed for the completion of the 7-day test and at least 31 days shall be allowed for the completion of the 28-day test. The cement shall be tested in accordance with the methods hereinafter prescribed. The 28-day test shall be waived only when specifically so ordered.

V. Rejection

12. The cement may be rejected if it fails to meet any of the requirements of these specifications.

13. Cement shall not be rejected on account of failure to meet the fineness requirement if, upon retest after drying at 100 C. for one hour, it meets this requirement.

14. Cement failing to meet the test for soundness in steam may be accepted if it passes a retest, using a new sample at any time within 28 days thereafter.

15. Packages varying more than 5 per cent from the specified weight may be rejected; and if the average weight of packages in any shipment, as shown by weighing 50 packages taken at random, is less than that specified, the entire shipment may be rejected.

Frequently the chemical properties are not determined on each carload, it being generally thought sufficient to make an occasional analysis for sulphuric anhydride and magnesia or to omit these tests entirely. If the physical tests are all good there is no need for adding to the expense for testing, unless the use of the cement is such that limits for certain elements are advisable.

The story to be told by each test is, in most cases, obvious. They show the rate of hardening, the strength and rate of improvement with age, the sand-carrying capacity and the general condition of concrete or mortar which may be expected with the passage of time. It is safe to say that any cement which passes these requirements is good.

While the almost universal use of cement testing is comparatively recent, the testing of concrete aggregates is far more recent. In fact, it is only within the past two or three years that these materials have been investigated to any appreciable extent. Sand is undoubtedly the worst offender among the constituents of concrete, but it still pretty generally devolves upon the cement company to prove this fact. Concrete seldom develops any defects without the contractor's making a demand on the cement manufacturer to pay for the damage. In the writer's experience, it is found that there are about ten cases of poor sand to every one of poor cement.

The most common cause for poor sand is the presence of loam. Cement will not carry loam, and even increasing the richness of the mixture will not make good concrete. It simply will not harden properly and sand of this kind should always be rejected. Unfortunately, the quality of sand cannot be told, excepting in rare instances, by its appearance, but there are tests which will tell absolutely.

It is customary to conduct tests for tensile strength in comparison with standard testing sand, using a cement of known good quality; for fineness or grading by means of sieves of definite sizes, and for the presence of organic matter. Just now there is considerable discussion regarding the substitution of a compression strength test instead of the tensile test usually used on the ground that concrete is always used under compression. We shall not attempt to participate in the discussion in this article.

As already said, loam is the most common cause for poor sands but run-of-bank gravel is a close second. Concrete must, of course, be fairly accurately proportioned to give the desired results. Gravel, as it occurs in most banks, contains considerably more sand than true gravel and as a result the concrete will contain an undue percentage of sand and a small amount of coarse aggregate. Bank gravel should always be screened before using, and the resulting sand and gravel, if of good quality, properly proportioned before mixing again.

On much small work, these conditions are not attended to. Poor concrete results, and the testing laboratory may be called on for a post-mortem instead of for a preliminary diagnosis. It becomes necessary in such cases to dissolve the cement out of the mixture as used and, by screening the separated aggregate, determine the amount of sand and stone. It is impossible to tell, with any accuracy, the quality of the original materials. Nothing can be said of the cement. This is destroyed by the analysis. Also any organic matter originally present in the sand has been consumed.

Stone or coarse aggregate can generally be passed upon without test. It is of value to ascertain the proportions of particles of various sizes or the grading, and this can be done simply by means of a few sieves, but the nature of the particles themselves can be as well studied with a hammer as by means of an extensive series of laboratory tests.

The two most important materials of construction for large buildings are, of course, concrete and steel. The use of the testing laboratory with relation to the former has been told. In the case of steel, the architect usually calls for a standard structural grade, here again using the requirements of the American Society for Testing Materials. Inspection is then entrusted to some reputable testing laboratory, which sends its representative to the steel mill, where the rolling is carefully observed; tests of specimens from each melt are witnessed to determine the tensile strength, elongation, bending, etc., and weights and dimensions are checked.

Shop inspection includes no tests, but in the realm of steel there is no service of more value. The fabricating or bridge shop receives its steel from the rolling mill and builds girders, beams, columns, etc., all ready to be put together on the building site. The inspector makes regular visits to the shop, or works continually in the larger shops. He has copies of all detail prints for each of his jobs and he goes over each member with the utmost care, checking dimensions, location and punching of holes, testing rivets, and, in short, seeing that each and every piece is exactly as ordered. As a result, a well inspected steel job will fit together in the building without need of troublesome and costly alterations.

There are of course many ways other than in testing cement and inspecting steel in which a testing laboratory works with the architect and engineer. However, these two services are the most frequently used and most regularly needed. Brick, lime, paint, putty, plaster, etc., are often examined, but not to the extent of these already mentioned, and it would needlessly prolong this paper to discuss them.

It would hardly do to close an article on this subject without mentioning briefly the inspection of treated lumber. This is generally impregnated with so-called creosote oil, but treatments with such substances as zinc chloride and sodium fluoride are on the increase for building construction. Inspection of this material comprises an examination of the untreated wood, analysis of the impregnating oil and inspection of the creosoting process, including the steaming vacuum and pressure treatments, so that the resulting lumber shall contain the right amount of the proper kind of preservative. On the quality of treatment the life of lumber depends.

The equipment required for the larger testing laboratories or inspection bureaus is extensive and many skilled men must be kept upon their pay rolls. Furthermore, the recompense for this class of work has never been commensurate with the value of the work performed. Clients' battles must be fought, as protests against rejection are not infrequent and the laboratory must be in a position to prove its contentions.

Architects and engineers are continually increasing their demands for work of this character and are more and more conscious of the value of this extra care in seeing that the owner gets what he pays for.

The Essex County Tuberculosis Hospital

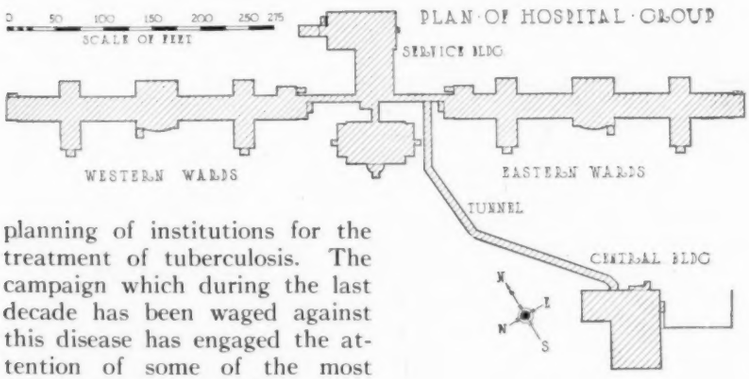
MIDDLETON, MASSACHUSETTS

JOHN H. BICKFORD COMPANY, BOSTON, ARCHITECTS *and* ENGINEERS

By REUBEN H. DOCKHAM

PROBABLY only those who specialize in the planning or equipment of hospitals, or who are connected in some way with their administration, are familiar with the rapid development which is taking place in this department of architectural work. The institution which is regarded today as the last word in planning is before long out-distanced by another, wherein are embodied still more advanced ideas of planning or details of equipment.

This progress is particularly manifested in the planning of institutions for the treatment of tuberculosis. The campaign which during the last decade has been waged against this disease has engaged the attention of some of the most eminent members of the medical profession, and assisting them have been schools of research and carefully trained specialists in many forms of allied effort ; the entire movement has been supported not only by public funds, but also by those of powerful foundations, and the whole has resulted in a great outpouring of popular interest and enthusiasm. As might be expected, therefore, a modern hospital when planned upon a considerable scale for the treatment of tuberculosis in its varied stages is apt to represent the highest type of excellence which this combined effort has put forth.



It is not long ago that buildings for the treatment of tubercular sufferers were crudely built and equipped, as it was deemed necessary only that the patient be supplied with open air accommodations and good food. These buildings were termed "shacks" because of their crudeness. All this is changed, however, and a modern tuberculosis hospital is not merely a "patients' boarding house," but a highly developed and fully equipped institution for the care and treatment of tubercular patients, and also for the carrying on of research work in this particular field.

The Essex County Tuberculosis Hospital, popularly known as Essex Sanatorium, located in the Town of Middleton, about 25 miles north of Boston, is the most recent of its type and is considered the most complete of any yet built. Situated on a hillside and overlooking a wide expanse of open country, the hospital immediately impresses the visitor with its air of entire completeness, and as being an institution in the planning of which good taste

in architecture has been joined to a high degree of engineering skill.

Some distance back from the public highway, and against a background afforded by a wooded hilltop, stretches the long and finely proportioned group of buildings, consisting of a central pavilion flanked upon each side by a symmetrical wing, joined to the pavilion by a one-story glazed arcade. The pavilion has three stories and a low basement, while the wings have each two stories and a low basement. Great care has been taken to give the buildings a suitable architectural expression, rich in simplicity and proportions.

The buildings face about ten degrees west of south. The front exterior walls are treated with gray stucco of moderate roughness of texture, relieved with a trim of ivory white artificial stone. The exterior rear walls are veneered with a very light shade of vitrified brick. The backing of all exterior walls is interlocking hollow tile.

The Main Pavilion

As the visitor enters the Administration Building through the main doorway under a semi-circular portico he finds himself in a broad hall which is a reception room for visitors and patients. Here are the general office and Superintendent's private office adjoining, both on the left of the spacious reception hall, while on the right are the medical offices consisting of the Superintendent of Nurses' office, examination room and throat room, all of which are equipped with the latest fixtures and devices for determining the various phases of tuberculosis.

The second and third stories of the Administration Building contain the sleeping rooms for certain members of the staff and the nurses, complete with sitting room and baths, while in the basement are located the X-ray room with as complete an equipment as money will purchase, a fully equipped pharmacy and a laboratory supplied with the most modern apparatus and devices for both pathological and research work. Here also are several small offices, and the general linen room for the whole institution, besides record vaults, toilet rooms for both men and women and a large general storeroom.

As one passes from the reception hall in the first story of this building, one may continue through the glazed corridor to the patients' dining hall, a room spacious in size, architecturally attractive and full of light and cheerfulness, the room being supplied with light and air by four very large windows on each of two sides and having semi-circular transoms that may be opened inwardly. These windows open toward both the east and west, therefore this room is supplied with sunshine both forenoon and afternoon.

Immediately in the rear of this dining hall is the service building, in which on the first floor are the nurses' dining room, servants' dining room, the serving room for the main dining hall, the main kitchen and the steward's room.

The serving room is placed so as to give rapid and convenient service to all three dining rooms and is equipped with steam tables, hot closets, a specially designed milk cabinet cooled from the refrigerating system, cup warmer, bread and pastry cabinet, ice cream cabinet, coffee urns and the customary small utensils for quick and economical service. Adjoining the serving room is the main kitchen, to one side of which and opening into the serving room is the dish washing room. The kitchen, including the dish washing room, is a marvel of compactness and convenience, and is equipped with all modern devices and machines to save labor and allow of rapid and skillful work. Especially interesting is the arrangement of the large French range and the steam cooking fixtures, all of which are grouped in the middle of the room with ample space all around, while an eight-door refrigerator is close to the chef's cooking table.

Patients' Dining Room in Rear of Administration Building

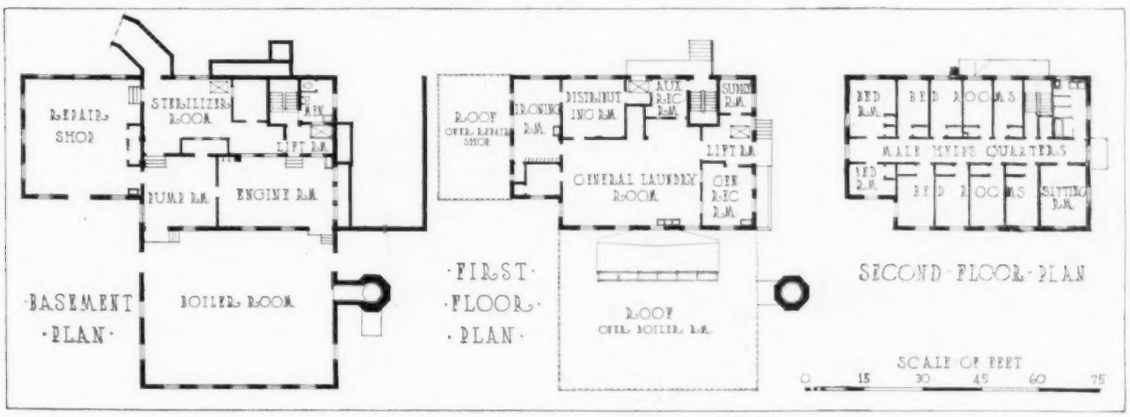
The dish washing room was especially designed for cleansing and sterilizing the dishes used by the patients, which are kept entirely separate from those used by the staff, nurses and servants. The machine in this room will wash, sterilize and dry

2000 pieces per hour if run to its full capacity, and all with the help of two persons. In the basement of this building is located the bakery, the equipment of which in point of convenience and completeness rivals that of the kitchen above. Here also is the cold storage plant, divided into five separate compartments to avoid a transference of natural odors, and which is of a capacity that, when filled, would defy the effects of possible strikes, embargoes on transportation lines, or the designs of profiteers. One of the most unique and important adjuncts to the cold storage plant is the garbage cooler, so arranged and connected to the ammonia circulating system that all garbage from the hospital buildings is kept at a temperature that will not breed or attract flies, nor permit ferment prior to its being taken away. Other adjuncts are the ice making tank and storage space for ice. Near this section of the basement are two storage tanks of 5000-gallon capacity for water. These tanks are supplied with necessary additional pressure to supplement that of the public water service. Town water pressure at this basement level is indicated at 31 pounds per square inch, which is too low for good service upon the upper floors of the hospital buildings. This pressure is augmented in the storage tanks by means of electrically driven pumps, automatically controlled, to give a suitable working pressure. An ingenious arrangement of valves provides for the instant segregation of the hospital water system from the town supply, always with a reserve of 5000 gallons. All drinking water, and that used for cooking purposes, both hot and cold, is thoroughly filtered.

A Typical Ward Showing Lighting, Heating and Ventilating Arrangements on Wall toward Corridor

The Hospital Wards

The two long two-story wings which extend to the right and left of the central pavilion or Administration Group just described, with which they are connected by glazed arcades, contain the quarters occupied by the patients themselves. Each of these four floors is organized and administered as a separate hospital; each has its own staff of nurses and attendants, and the result is practically four wholly separate institutions, each of which is devoted to the treatment of tuberculosis in some one of its various stages. It would be difficult to imagine anything more complete than the arrangement of these subsidiary hospitals, for each is planned with the idea of making it as comfortable as may be for the patients, and also with a view to making possible the most effectual work on the part of nurses and attendants. Through each of these minor hospitals there extends on the north side a long service corridor from which one may enter the wards and the various rooms and departments which pertain to their operation. Each of the minor hospitals has three so-called "terminal rooms," and each has its own isolation room, cut off by air locks, for contagious diseases. These rooms are so arranged that they may be entirely isolated from the rest of the hospital, and each has



Floor Plans of Service Building
Essex County Tuberculosis Hospital, Middleton, Mass.

its screened sleeping porch and communication by stairway with out of doors. Instead of having one general wash room and dressing room for patients in each of these separate hospitals, each of the larger wards has its separate wash room opening directly from it and part of each wash room is divided into tiny dressing rooms, each of which is shared by two patients, each patient having his own steel locker in which his small belongings are kept.

In hospitals for the treatment of tuberculosis arrangements are made for keeping the patients in the open air as much of the time as is possible. In this instance the wards are intended to be open to the air, in all but the most extreme winter weather, by means of casement windows, and in order that the air within the wards may be kept in constant circulation in cold weather, heating radiators are placed along the walls which divide the corridors from the wards, and *opposite* the windows in order that the warm air, rising from near the floor, may assist in keeping the air at the patients' heads in constant motion. The lateral porches, with which this hospital is provided, are a very successful solution of a problem which heretofore has meant the darkening of the wards and exclusion of the sun; here they are placed so that their *smaller* dimensions join the building and at points which are not occupied by wards, so that neither light nor air is kept from the patients.

In planning this sanatorium three other important adjuncts have been provided. In the basement of the East Ward building is an assembly room supplied with complete moving picture apparatus. This room will seat nearly 100 persons and is marvelously light and airy and attractive for a basement room. In the West Ward building, in a corresponding position to that of the assembly room, is a chapel with a seating capacity of 75 persons which is equally attractive in point of light and air as the former room. Both of these rooms are artificially ventilated and each is supplied with a small emergency room and toilet facilities for men and women.

As death is always liable to be in the midst of the occupants of an institution of this kind, a mortuary room becomes necessary, and this has been supplied in the rear of the basement of the West Ward building and at a point where the transfer and attention to a deceased patient is attended with the greatest privacy. This room is complete in every detail and includes an autopsy table, a four-section cooler and surgeon's toilet facilities. This room is also artificially ventilated and heated by indirect steam.

To make the institution still more complete, each of the four hospital floors already described has an auxiliary examination room, one of which is thoroughly equipped as an operating room and one as a violet ray room. In the East Ward building is a thoroughly equipped barber shop, and in the West Ward building is a dental room with all of the latest appliances for caring for the teeth.

Central Power and Heating Plant

An institution of this size (it readily accommodates 200 patients) requires a central power and heating plant, and this has been provided in a separate building about 300 feet from the main hospital buildings and connected with them by a service tunnel or subway through which pass the steam pipes and electric cables. This tunnel simplifies the traffic to and from the main hospital buildings and makes possible the unobstructed operation of the complete institution irrespective of weather.

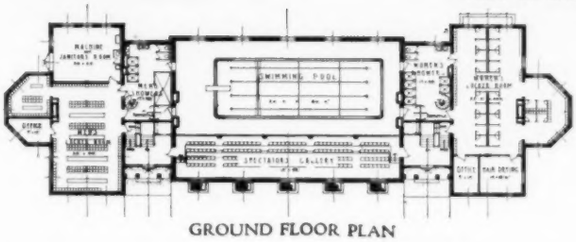
The engine room contains one 60-kwt. engine generator unit, installed primarily for power purposes, but it is so connected that current for lighting may be supplied from it in case of temporary failure of the Town of Danvers municipal plant from which service is available for permanent lighting of the hospital buildings. There is ample space in the engine room for another engine generator unit. In the pump room adjoining the engine room are one steam-driven and one electrically-driven vacuum pump, and one steam-driven and one electrically-driven boiler feed pump, making the possibility of a failure of the heating plant exceedingly remote. These pumps all operate automatically and are connected to a central tank which receives the drainage from the entire heating and power systems and returns it to the boilers. In this room is also located a triplex fire pump, so connected as to deliver 120 gallons of water per minute at 100 pounds pressure to a hose attached to any one of five hydrants distributed about the hospital buildings. This pump also serves as an automatic booster of the water pressure.

The boiler room contains three 66-inch horizontal tubular boilers in brick settings, and the system of piping is such that either boiler may be run at high or low pressure, or one may be run high and another low at the same time. The plant is designed to heat with the vacuum system and during the heating period the exhaust steam from the engine and pumps may be turned directly into the low pressure heating main. By this process 60 kwts. of power are obtained as a by-product at little cost for fuel.

On the first floor of this building is the hospital laundry, a veritable model of its kind. It is supplied with the most modern machinery and each piece is driven by an individual, direct-connected electric motor, and is protected by safety devices to prevent accidents to operatives. There are sterilizing washers for the patients' clothing separate from another for the clothes of the staff and employes, and these washers are so built and installed that the soiled linen is put into the machines in special receiving rooms and is taken out clean on the opposite side of the washers in the main laundry room.

There are many other novel and useful features throughout the buildings to interest those who have to do with hospitals, and much may be learned by a study of this institution, which can truthfully be said to be the "last word" in sanatoria.

VIEW OF ENTRANCE FRONT



GROUND FLOOR PLAN

MAIN FLOOR PLAN

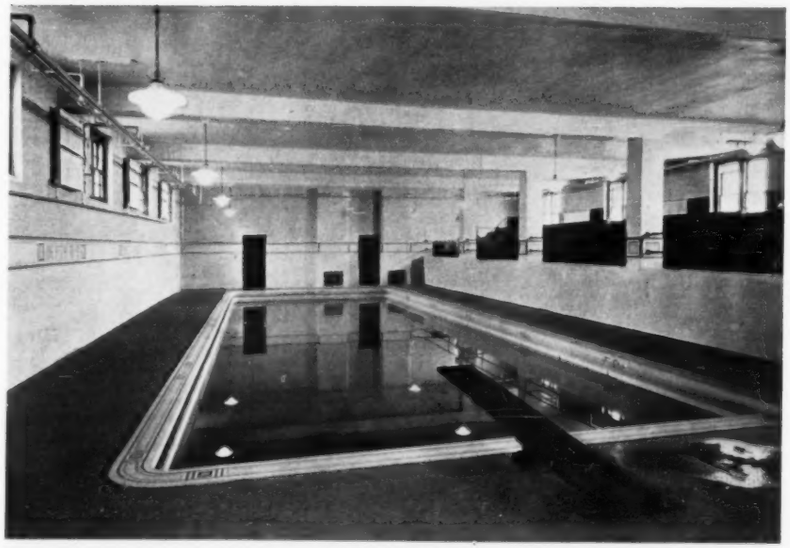
VIEW OF REAR AND END

RECREATION BUILDING, NEW HOLLAND, GA.

FOR EMPLOYES OF PACOLET MANUFACTURING COMPANY

KILHAM, HOPKINS & GREELEY, ARCHITECTS

WOMEN'S SOCIAL ROOM



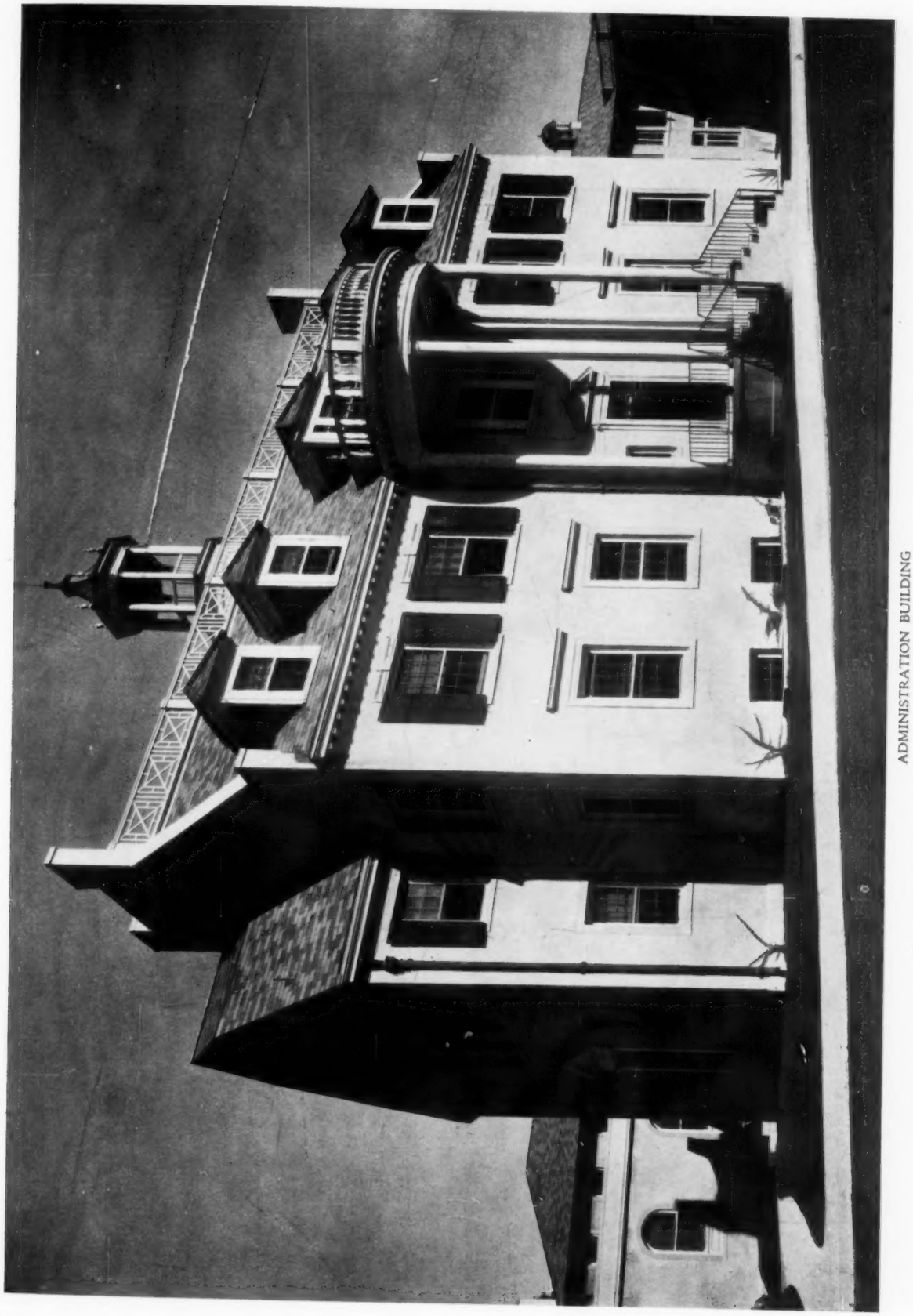
SWIMMING POOL

GYMNASIUM

RECREATION BUILDING, NEW HOLLAND, GA.

FOR EMPLOYES OF PACOLET MANUFACTURING COMPANY

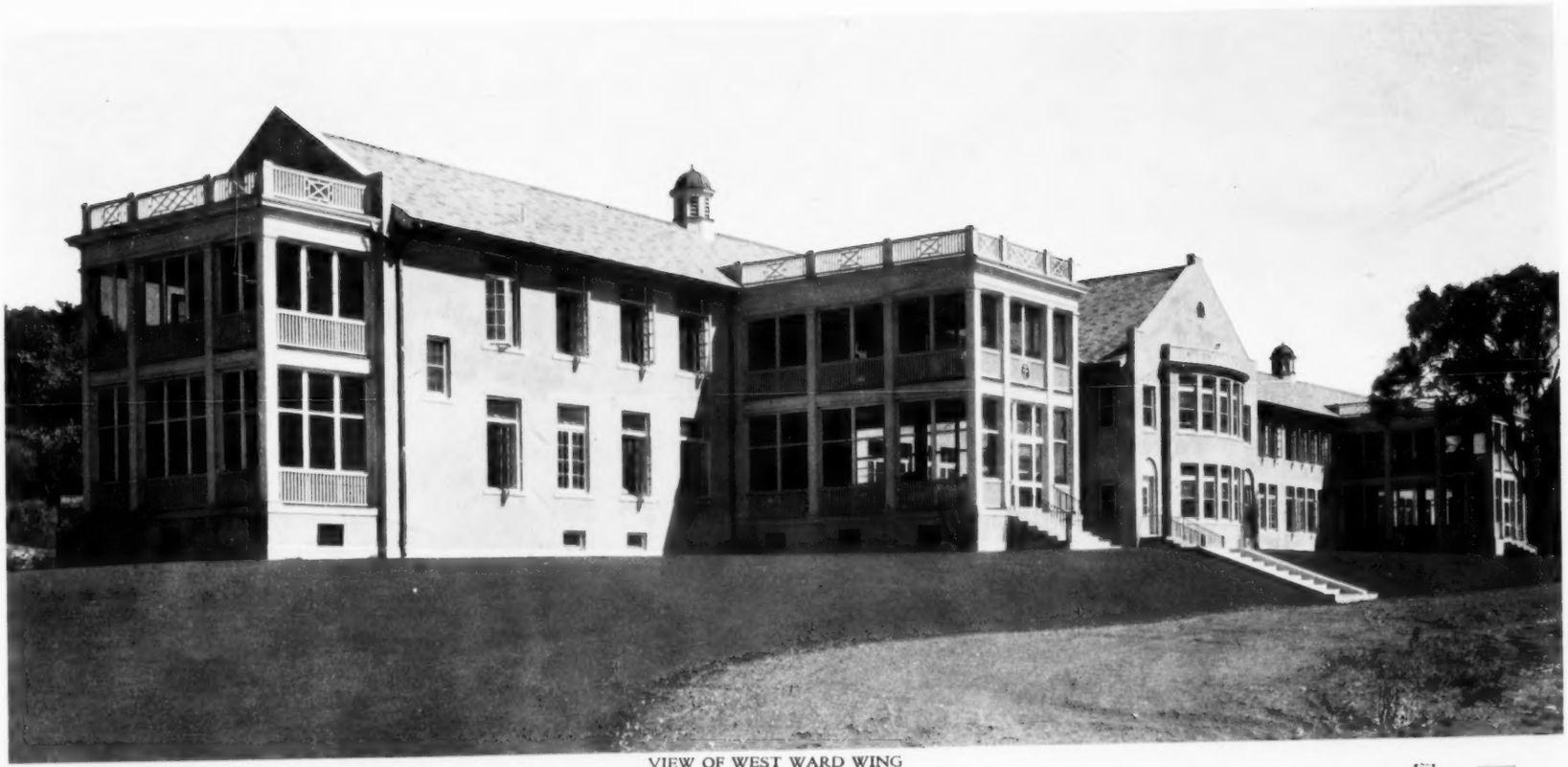
KILHAM, HOPKINS & GREELEY, ARCHITECTS



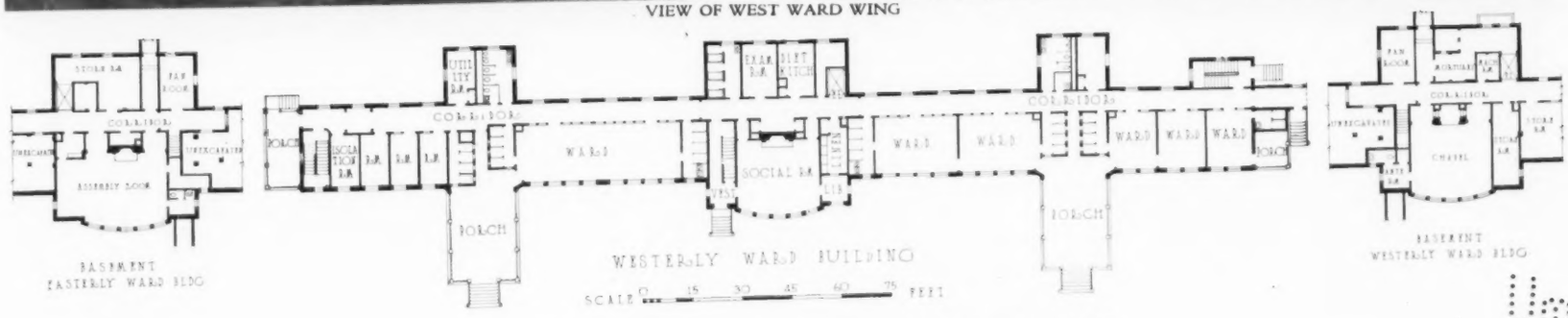
ADMINISTRATION BUILDING

ESSEX COUNTY TUBERCULOSIS HOSPITAL, MIDDLETON, MASS.

JOHN H. BICKFORD COMPANY, ARCHITECTS

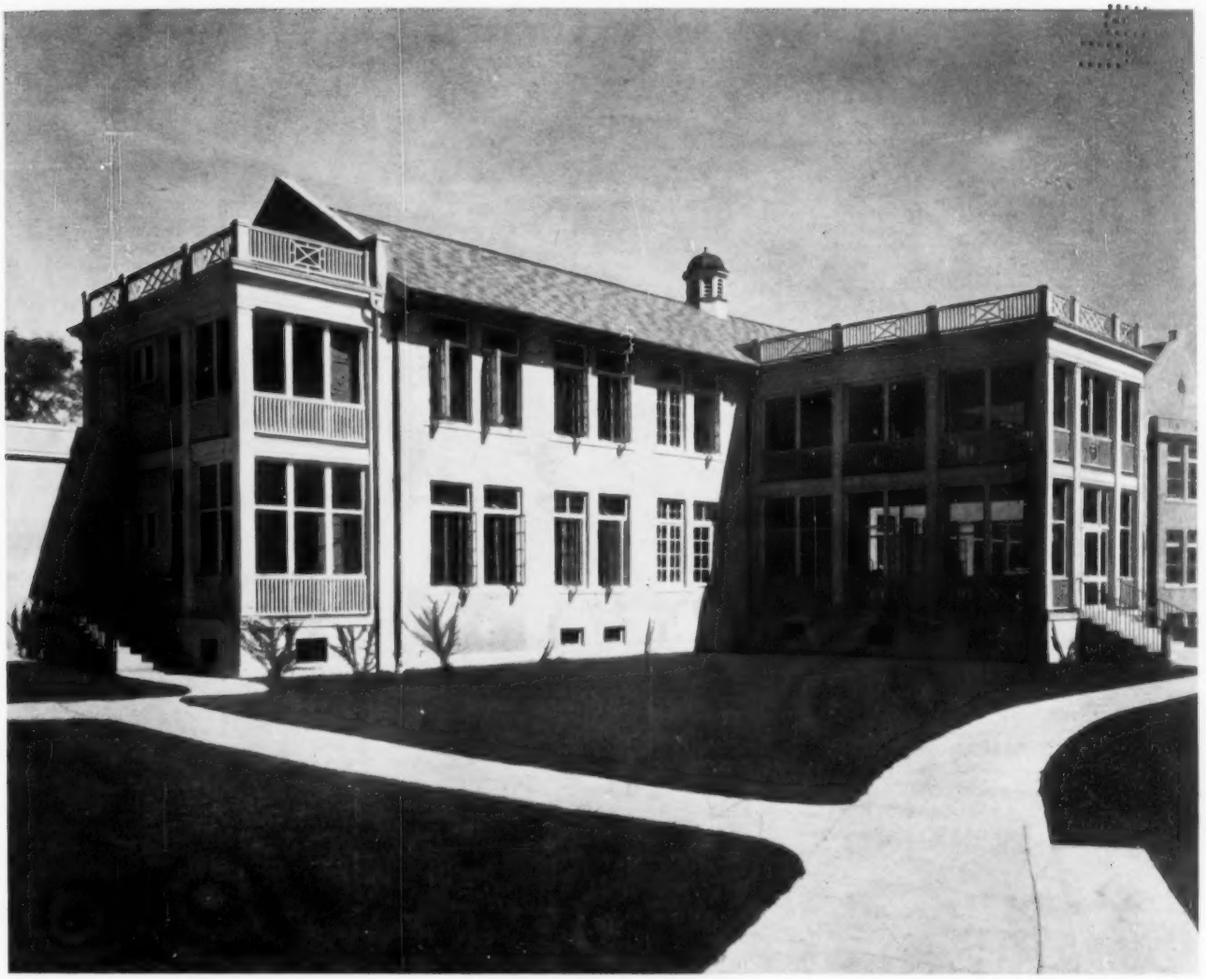


VIEW OF WEST WARD WING

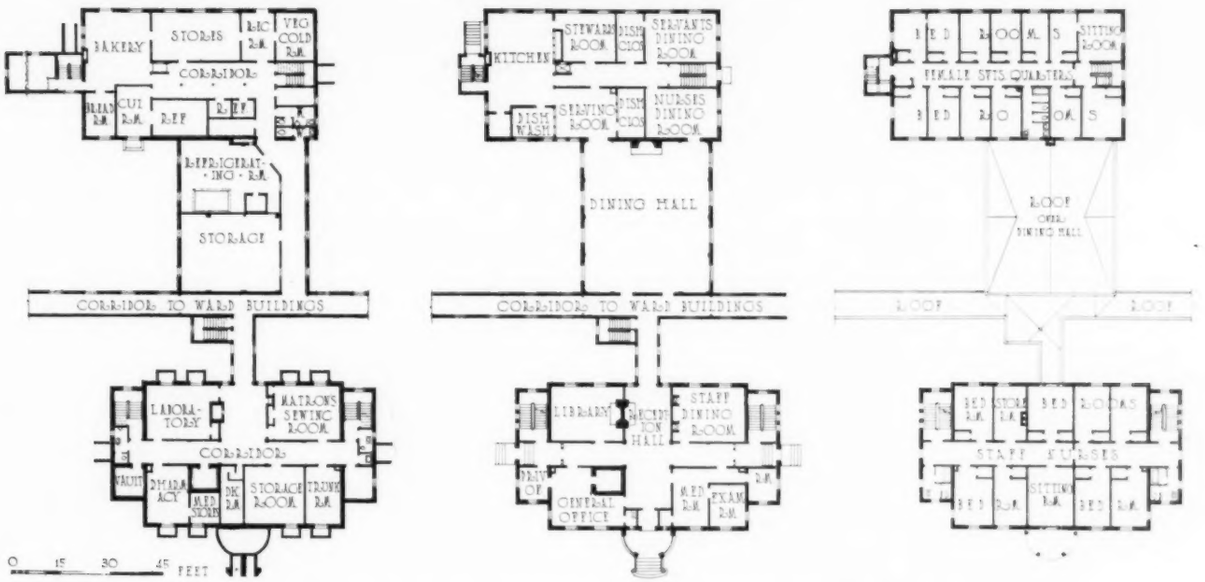


ESSEX COUNTY TUBERCULOSIS HOSPITAL, MIDDLETON, MASS.

JOHN H. BICKFORD COMPANY, ARCHITECTS



DETAIL OF EAST WARD WING



FLOOR PLANS OF ADMINISTRATION AND SERVICE BUILDINGS

ESSEX COUNTY TUBERCULOSIS HOSPITAL, MIDDLETON, MASS.

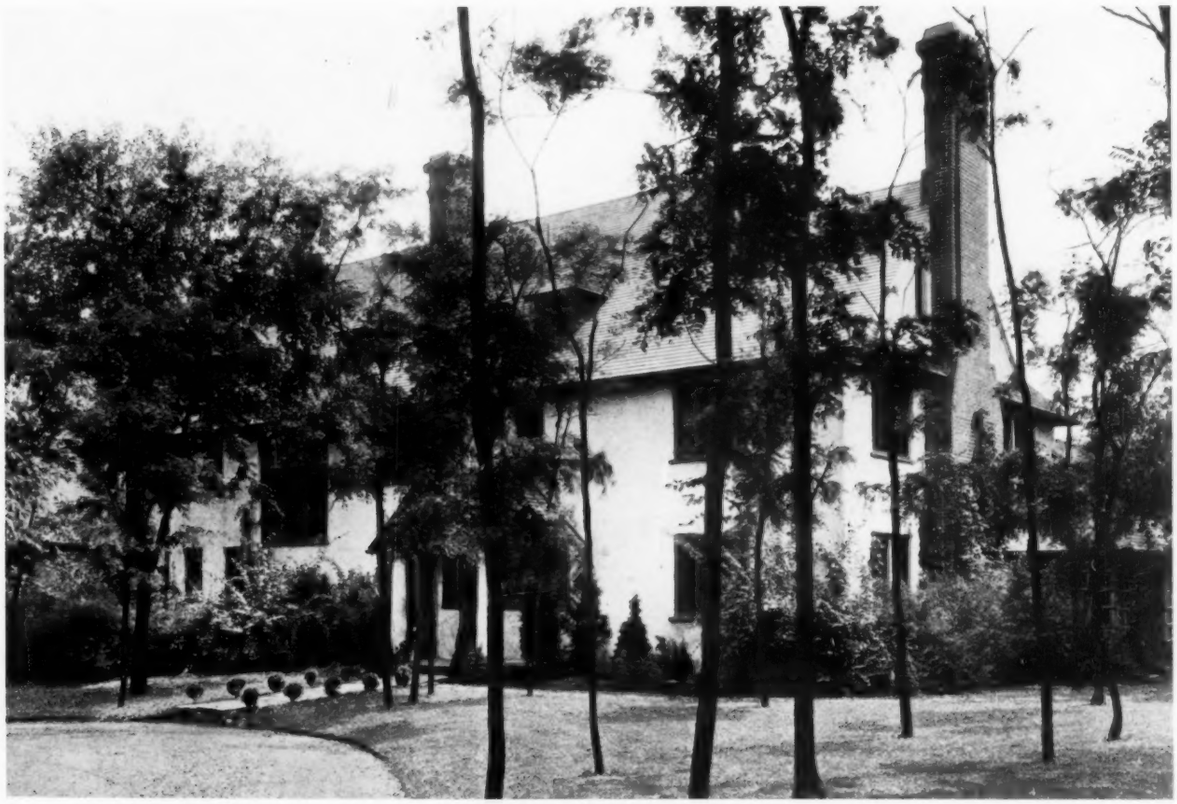
JOHN H. BICKFORD COMPANY, ARCHITECTS

GENERAL VIEW OF GARDEN SIDE

HOUSE OF DARRAGH PARK, ESQ., ROSLYN, LONG ISLAND, N. Y.

PEABODY, WILSON & BROWN, ARCHITECTS

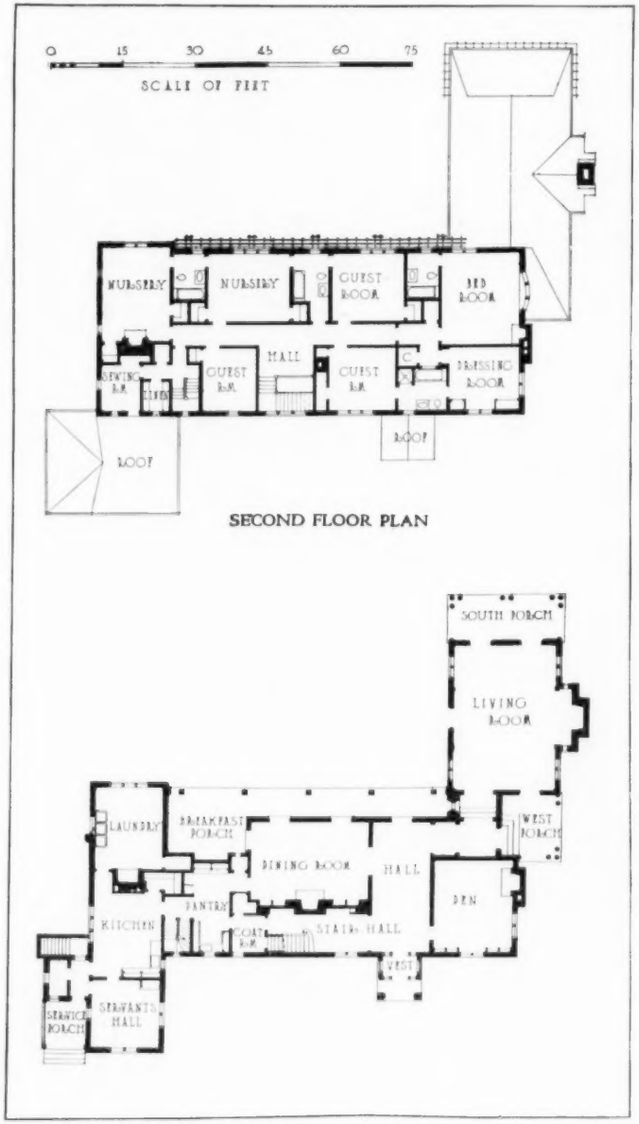
DETAIL OF LIVING ROOM WING

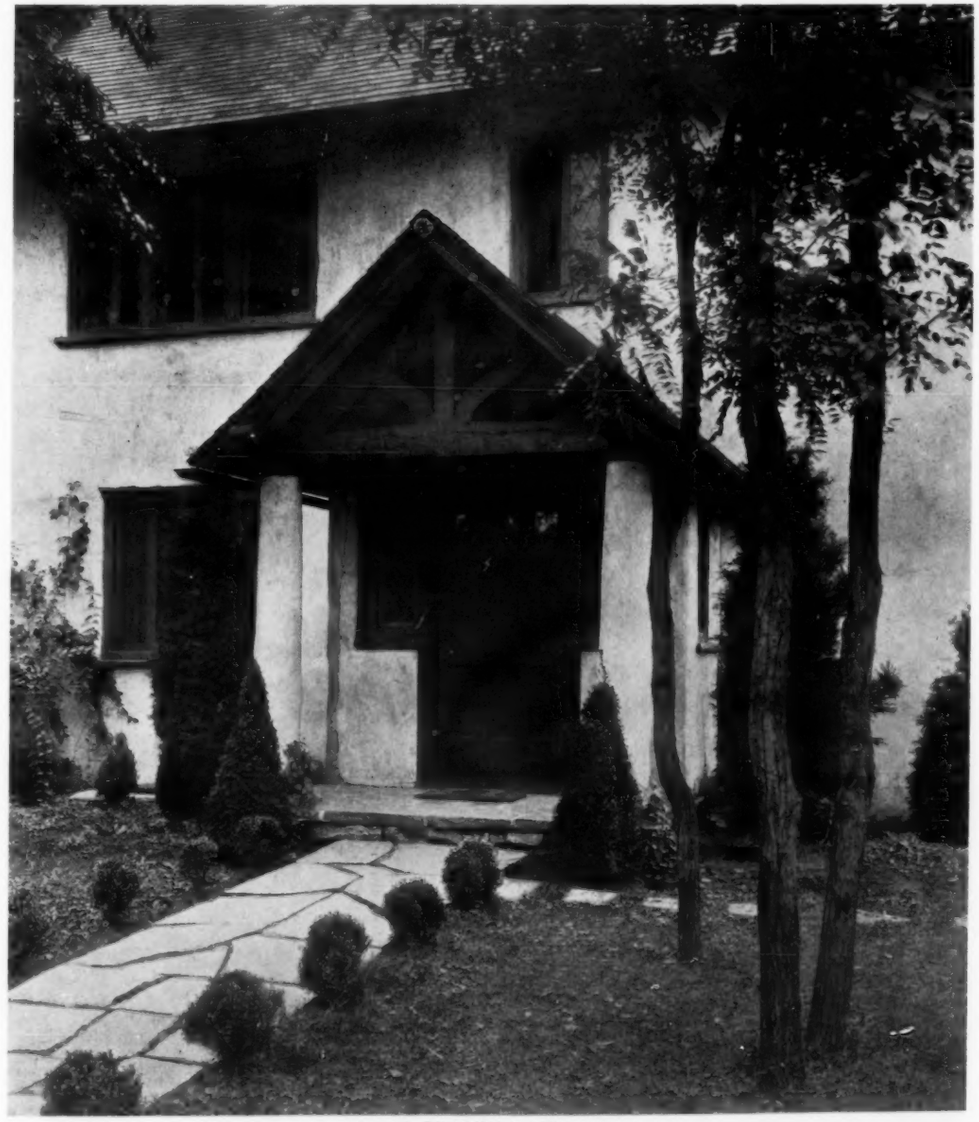


VIEW OF ENTRANCE FRONT

HOUSE OF DARRAGH PARK, ESQ., ROSLYN, LONG ISLAND, N. Y.

PEABODY, WILSON & BROWN, ARCHITECTS





DETAIL OF ENTRANCE PORCH

HOUSE OF DARRAGH PARK, ESQ., ROSLYN, LONG ISLAND, N. Y.

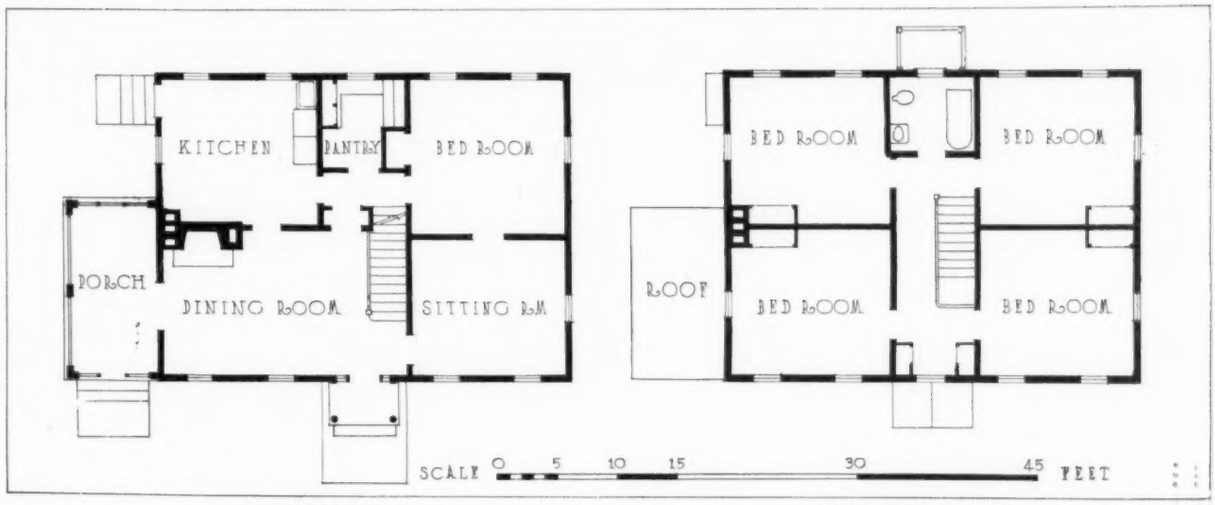
PEABODY, WILSON & BROWN, ARCHITECTS

LIVING ROOM

DINING ROOM

HOUSE OF DARRAGH PARK, ESQ., ROSLYN, LONG ISLAND, N. Y.

PEABODY, WILSON & BROWN, ARCHITECTS

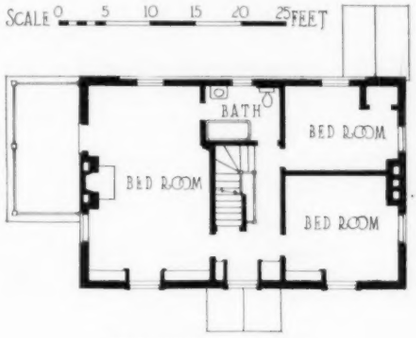


FIRST FLOOR PLAN SECOND FLOOR PLAN

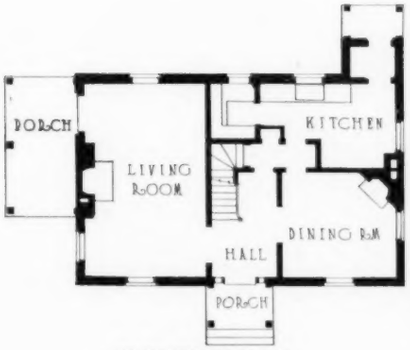
SUPERINTENDENT'S COTTAGE, ESTATE AT YONKERS, N. Y.

ALFRED HOPKINS, ARCHITECT

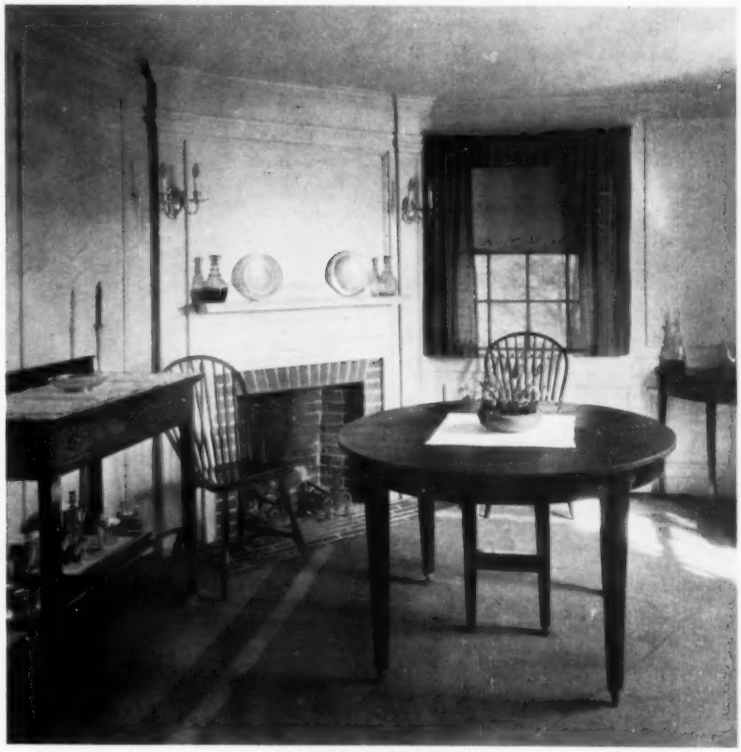
GENERAL VIEW



SECOND FLOOR PLAN



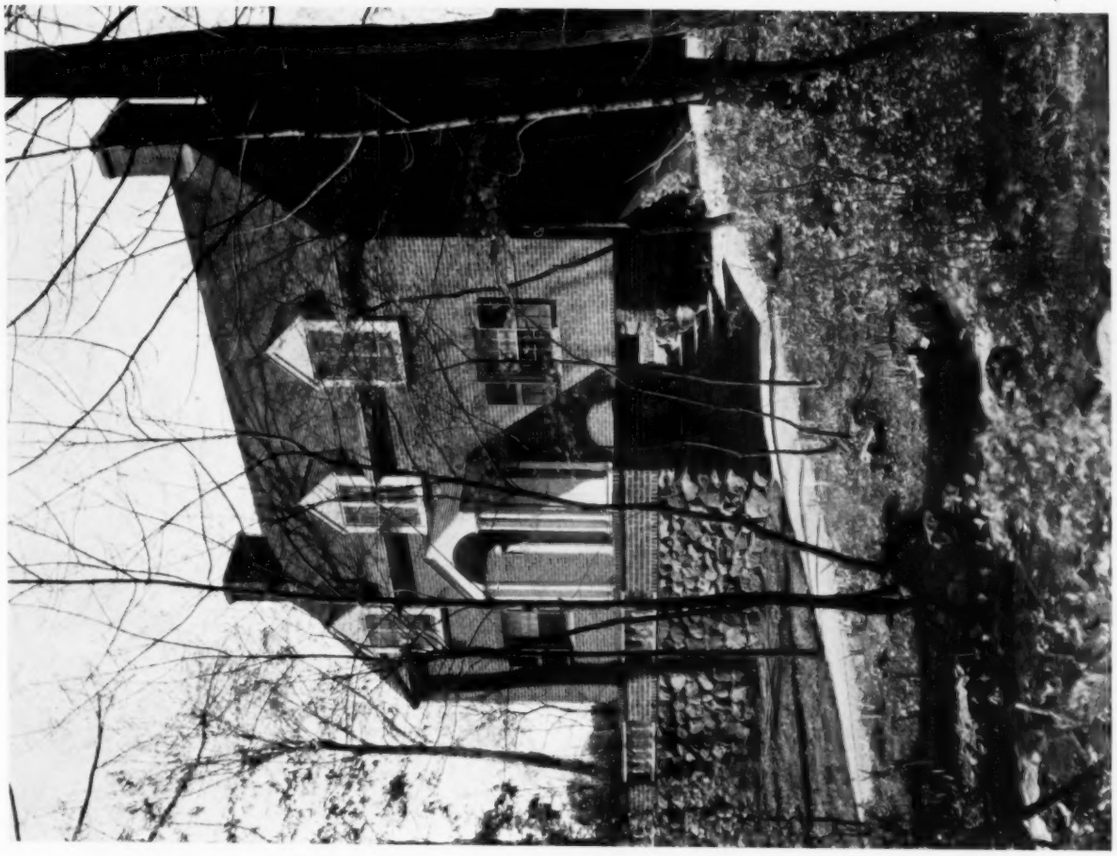
FIRST FLOOR PLAN



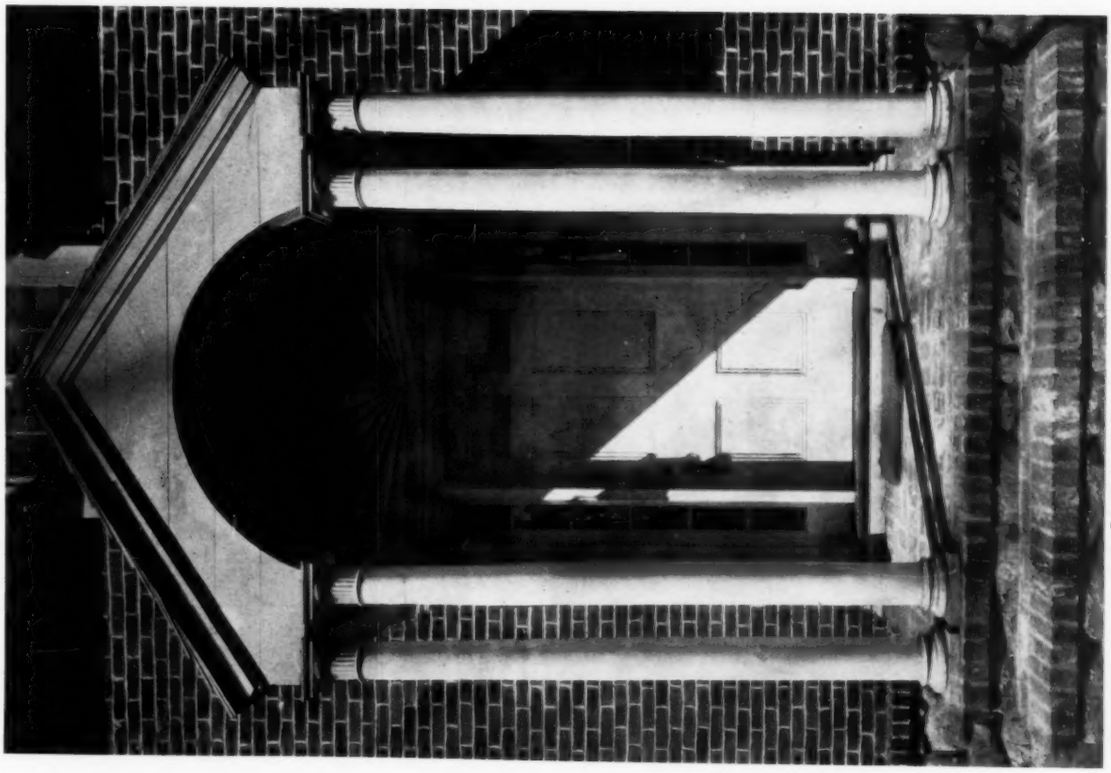
DINING ROOM

HOUSE OF WILLIAM V. MACDONALD, ESQ., BELMONT, MASS.

STANLEY B. PARKER, ARCHITECT



VIEW OF FRONT



DETAIL OF ENTRANCE PORCH

HOUSE OF WILLIAM V. MACDONALD, ESQ., BELMONT, MASS.

STANLEY B. PARKER, ARCHITECT

BUSINESS & FINANCE

C. Stanley Taylor, *Associate Editor*

Straight Talks with Architects

III. WILL YOU GET YOUR SHARE?

TWO months ago in this Department of THE FORUM the subject under consideration was the possibility of getting work immediately in architects' offices. Last month we discussed some of the individual and collective weaknesses which have operated to the detriment of the architect and of his profession. Some of the predictions which were made in these articles have already come true. We find today a peculiar condition in the profession, which is shown by the fact that a considerable number of architectural offices are very busy, while an even greater number have little to do. As we analyze this condition further, it soon becomes evident that the architects who are busy are of the aggressive type and those who are not busy are numbered among those who wait.

The question of selling architectural service is one which has been discussed from practically all possible angles. There are many architects who hold the opinion that a definite attempt to sell architectural service is unethical. On the other hand, it must be realized that almost every architectural commission is obtained by salesmanship in one way or another; it may not be through the employment of the principles of direct salesmanship, but through the more indirect method of developing social contacts or waiting for commissions to come into the office through the recommendation of satisfied clients.

Just a few days ago we were in the office of a well known architectural firm. We found little action there—the working force had been reduced to almost a minimum—the drafting boards were covered and an air of inactivity pervaded the entire premises. We could not help but contrast this condition with that of an office visited the day before, where millions of dollars' worth of apartment houses were being designed to meet the active demand existing in the sections of New York directly affected by the tax-exemption ordinance. The former office has for years borne a high reputation in the architectural field; the latter, where work was active, is not so well known, but is destined to be one of the great architectural firms of the next decade.

In an interview with one of the principals in the idle office, we were asked: "Why is it that with so much activity going on in this district, we are not busy?" Our answer was in some detail and may be gathered from the statements made in these paragraphs. What we were really interested in was *why* the other office was so busy and *how* the work was being obtained.

In this office, after the passing of the tax-exemption ordinance in New York, a careful study of the trend of the real estate market was made, particularly to determine what class of buildings would be erected to take advantage of this tax-exemption. It was not difficult to guess that the new housing which would be provided must consist of moderate cost individual and two-family houses and apartment houses. It was felt that in sections of the city where land values were too high for individual houses, but low enough to construct moderate cost apartment buildings on a paying basis, activity on the part of speculative builders could be anticipated. This prediction was made even more sound by the fact that there were several districts of this kind where adequate rapid transit facilities had recently been provided.

To interest prospective investors in entering upon building ventures, facts and figures must be determined, and practical types of apartment houses designed to meet public approval must be evolved. All this meant a certain amount of gambling in time and effort, but having a definite objective in view, tentative plans of two or three buildings were prepared and prices of available real estate were determined. The next step consisted of direct selling, in which the architect visited a number of logical prospective clients and showed them exactly what types of buildings could be built; what they would cost, together with the land; what return might be expected on the investment, and what margin of profit for quick resale to ultimate investors might be expected. At first it was difficult to convince, but finally the first client decided to proceed with a venture of this nature. Soon after that others came into line and before long, in the section selected by the architect, a considerable boom was on the way, and the reputation of having designed some of these buildings brought in more and more work, until the office had reached the busy stage in which we found it.

Studying the Business Phases of Each Project

Perhaps the strongest favorable impression which can be made upon the client of an architect is developed when the client realizes that his architect

is possessed of sound business judgment. The impression is strengthened again if the architect seems to possess more than the usual amount of knowledge regarding the particular purpose for which the building is planned.

Not long ago there came to our attention a project which involved the design and construction of a large office building. This building was being built as an investment and paid for out of war profits. Tentative plans had been filed as prepared by a prominent firm of architects. Shortly thereafter we noted the filing of a new set of plans by a younger architect, who as yet had carried out no large project of this nature, although in the course of his previous employment he had been with firms where such experience was available to him. Being acquainted with one of the principals of the owning company, we inquired the reason why this architect had been employed rather than the prominent firm which had prepared the first set of plans. It turned out that the cost of building from the first plans filed proved to be greater than was warranted by the expected revenue under conditions that now hold, and the building project was for a time dismissed. The younger architect learned of this and promptly made a study of the tentative plans, calling into consultation an experienced building manager. Many defects which would reduce the rental income and increase the cost of maintenance were found in the first set of plans and an entirely different set of sketch plans was developed in which it was clearly indicated that the cost of maintenance and operation would be less, while the space was utilized to provide a greater income on the same expenditure of money.

Those who have money to expend in the building field today are generally hard headed business men who respond more quickly to an appeal made along business lines than through the æsthetic appeal of a well designed exterior. Realizing this fact, the younger architect did not present at the first interview an elevation or perspective, but merely based his argument on the floor plans which he had developed, saying that if they were further interested, he would be glad to show the elevations of the proposed building. Proceeding thus along businesslike methods of approach, this architect was able to bring into his office the largest commission he had ever handled. The fault with the larger organization is to be found in the fact that they did not realize the value of consulting a building manager, and had merely produced another office building, well designed it is true, but showing the same waste of space and disregard of maintenance cost that are to be found in the average hotel building and many office buildings today.

Entirely aside from the architectural and engineering problems involved in a new building project, we believe that the first idea on the part of the architect should be toward making the building a machine highly efficient in accordance with its intended purpose. This means not only a study of the plans of other buildings which in times past have been built for a similar purpose, but an actual examination on the ground of the functioning of these buildings to determine through experience of others those points which should be incorporated in planning a new building, or items of design and equipment which for one reason or another should be omitted. To illustrate this point, we may refer briefly to one instance. In this case the architect had drawn plans for an office building and had incorporated the equipment for a stationary vacuum cleaning plant. Fortunately, and largely through the insistence of the owner, his plans were gone over by a building manager. Among many recommendations was one to the effect that the portable type of vacuum cleaner would represent considerable less investment and a lower cost of operation and provide eminently satisfactory service for the particular building. The architect investigated and obtained data on several installations of each type in buildings of similar size and kind, finding that the building manager's judgment was correct and saving the owner a sizable item in original building cost.

Follow Construction Costs Closely

In the past, architects have often been charged with failure to keep closely in touch with actual conditions in the building field and failure to maintain a thorough working knowledge of costs. The result has been that in preliminary discussions of a project, and even in the preparation of sketch plans, the architect's tentative cost estimates have often proved misleading to the client. To such an extent has this been true that there are on record many instances where a client has refused to go beyond the sketch plan stage, because the cost seemed too high, when in reality a careful combing of the field might have resulted in obtaining information upon which a lower cost could be based.

Another period of disappointment to the client is the time when he has ordered working drawings and specifications to be prepared on a basis of estimates furnished him by the architect. When actual contract and sub-contract figures have been obtained, it is quite often found that these figures are much higher than the estimate given by the architect. This is a situation which in nine cases out of ten serves to discourage the client and to prevent the carrying out of the project. If it is found difficult to obtain comparative costs in order to provide a tentative estimate, it is much better to inform the client frankly that the tentative cost estimate was based only on general information and that the actual figures cannot be had until plans have been developed to a point where actual estimates on material and labor can be obtained. The average client, particularly in the case of owners of business buildings, will be found fair minded in this matter and appreciative of the architect's frankness and co-operation and his apparent willingness to serve the best interests of the client.

It is a great mistake to assume too much knowl-

edge, and this is a common error among architects today, particularly among those who are in the early stages of developing their practices. In view of the complexity of the modern building operation no reasonable person would expect an architect to know everything. Consequently, the best practice today involves the employment of consultants who are specialists, particularly in connection with the mechanical installation problems of a building project. Difficult problems of heating, ventilating, acoustics, fireproofing and structural engineering should never be undertaken excepting under the guidance of consulting engineers or with the services of a staff member who has a thorough knowledge of the subject involved. In cases where the project is tentative in its nature, and the architect may be doing a certain amount of preliminary work, it will be found that the average consulting engineer is entirely willing to co-operate on a very reasonable basis. Similarly, in problems of actual construction, it is the part of wisdom to consult with a practical building contractor or sub-contractors in order to incorporate practical features in planning and to avoid mistakes which are commonly found in working drawings and specifications tendered to bidders.

Standardize Your System of Charges

In analyzing the methods of charging clients for services by various architects, we have been frankly surprised to find how many are working on some form of cost-plus basis. It would seem that we are now in an evolutionary period, not only regarding the scope of architectural service but also the method of charging for it. As a basic consideration, it is evident that a professional service of any kind will be paid for by the public, not on a standard charge or percentage charge, but in accordance with the experience and ability of those who render such service. This condition has been generally accepted in the legal and medical professions, among others. On the other hand, many architects have attempted to adhere to a fixed or standardized percentage of charges, based on the type of work involved. There has been too little consideration of the differential which enters into the situation because of the factors of skill and experience. Again, we have to consider the varying degrees of complexity in a building operation and the question of repetition of design in such cases as that of an industrial or other type of group housing project. Some of the methods of charging for service which have been brought to our attention are:

1. The straight percentage method, such as that suggested by the American Institute of Architects.
2. The lump-sum method, in which a price is quoted for full architectural service on a given project.
3. Various forms of cost-plus charges.
4. Salary basis.

The majority of architects work directly on a percentage basis, receiving fees which must include their operating expenses, leaving the balance for profit. The percentage charges vary considerably, depending upon the size of the project and the amount of work involved. The usual basis, however, quite closely approximates the schedule of charges as set forth by the American Institute of Architects.

The lump-sum method has been experimented with on numerous occasions but has been found generally unsuccessful, excepting in the speculative building field, where it is quite customary to maintain a standardized series of lump-sum charges, which may be so much for the plans of an individual dwelling under certain cost limitations, so much for the plans of a two-family house, and plans of apartment houses which are sometimes estimated on the basis of cost of architectural design per front foot. Naturally, there are many variations in this system of charging, and in most instances the architectural work does not include the preparation of detail drawings and specifications, as this work is done by the building contractor or speculative builder through his own organization and to a great extent through the offices of his sub-contractors.

The cost-plus system of charging seems to be gaining in favor. Briefly, this consists of arranging a contract with the owner by which he is to pay the actual costs, which are increased (usually doubled) to cover the overhead expense, and above this a percentage of the actual expenditure thus determined is allowed the architect for profit, the average being about one-third of the cost as estimated on the actual expenses-plus-overhead basis. Under this plan payments are usually made on monthly statements rendered by the architects.

A variation of this plan involves a payment of actual cost of the work plus an overhead charge by the client, and a salary to the principal or principals who may be engaged at any time on the work.

There exists today in the average architectural office a great need for a revision and standardization of charges. In many instances the prospective client's complaint that architectural service costs him too much is grounded on fact. We may take one brief example for consideration. Under the ordinary system of charging for architectural service, which involves a series of percentages, the various stages of the work are based on the cost of the building. He would find that a simple type of industrial building, involving very little detail architectural work but costing perhaps one million dollars, would develop an architectural charge equal to that of designing a one million dollar hotel. The work involved in designing the hotel might require five times the effort and expenditure on the architect's part as that involved in designing an industrial building. Naturally, it seems unfair that a standard percentage charge should apply in this case. The adoption of the cost-plus form of charging, however, would obviate all such difficulties. Any of these forms of charges involves careful bookkeeping, so that the records may be open to the client at all times.

EDITORIAL COMMENT

CONSTRUCTION THE IMMEDIATE SOLUTION OF UNEMPLOYMENT

THE president's Conference on Unemployment has adjourned after a number of meetings attended by representatives of the varied fields of social and industrial endeavor. The deliberations of the Conference have not resulted in any formula for changing conditions immediately for the better. Hardly any thinking person entertained any idea that the outcome would be otherwise; the present unemployment is the effect of economic conditions that must of necessity change slowly, just as they were originally brought about. The Conference has, however, not been without purpose; it has concentrated the popular attention on a subject of great importance to the nation, and as well as could be done with the limited organization available it has gathered data and information which the delegates have been requested to use to the best possible advantage in their local communities—and it is in the many individual communities that the problem must be solved.

An interesting phase of the Conference was the emphasis placed on the construction industry as the source from which most immediate general help can come. It is a recognition of the claims of many in the industry that construction is a "key" industry and emphasizes their objections that as such it has not been accorded its true importance in the fields of finance, government and transportation, all of which have laid upon it heavy burdens, while at the same time a determined fight was required to overcome adverse general economic conditions.

The Conference points to construction as the only immediate source of help and makes a special plea that public officials proceed with all road and public building construction for which funds can be made available. The number of men that such work can employ in a direct manner is large, but even of more importance is the work indirectly created for others because of the demand for construction products from the quarry, mill, foundry and factory. The Conference estimates that more than 2,000,000 people could be employed in construction.

The difficulties that must be overcome, as given by the Conference, are those that everyone connected with building knows—they are financing, material costs and labor costs. They present questions which cannot be answered in a national sense; they must be investigated in each community for itself. As formulated by the Conference they are:

1. Can the prospective investor finance the operation at a reasonable cost?

2. Does the cost of construction materials to the prospective investor properly represent the reduction which has been made in the wholesale prices?

3. Is labor in the particular locality working at fair rates and giving fair value in the quantity and quality of work done?

If local conditions permit a satisfactory answer to these questions, there is no reason why work should not proceed immediately. The report of the Committee on Construction Industries to the Conference makes this pertinent comment on these phases of the problem:

Financing "In every section of the country owners have declined to start new projects on account of the financing charges, both the interest rates and the commissions and premiums paid for floating loans being discouragingly high. Commissions and premiums varying between 10 and 20 per cent have been charged, in addition to from 7 to 8 per cent interest. It is doubtful whether the margins received by architects, contractors and all the producers in the basic industries involved in construction aggregate a sum equivalent to these financing charges.

"The savings deposits of the people are the natural economic source of loans for home building. The aggregate is ample for this purpose, even though a portion is protected by adequate investment in more liquid securities to meet withdrawals. There would be no difficulty in the financing of homes if the fundamental principle of the use of long term deposits for home loans and other long term uses were generally followed.

Material Costs "Manufacturers of building materials should be urged to make their readjustments promptly to a reasonable basis. They must realize that failure on their part to do so is not only limiting their own business but it is also interfering with the production and sale of other construction materials.

Labor Cost "This cannot be regulated by national action. The cost of living, rentals and working conditions differ in various communities. Where fair wage adjustments have not been made, construction is held up. Such conditions should be dealt with fairly and frankly between employers and workmen, and reasonable readjustments promptly made."

The value that the Conference placed upon the resumption of construction is seen in the recommendation that Secretary Hoover appoint a committee selected from the various elements interested in construction to be known as the Committee on Construction Development, which will be charged with the responsibility of preparing plans for co-operating with the governors and mayors in the several states and cities in carrying on community conferences to the end that local restrictions may be eliminated.

DECORATION *and* FURNITURE

A DEPARTMENT
DEVOTED TO THE VARIED
PROFESSIONAL & DESIGN INTERESTS
WITH SPECIAL REFERENCE TO
AVAILABLE MATERIALS

It will be the purpose in this Department to illustrate, as far as practicable, modern interiors furnished with articles obtainable in the markets, and the Editors will be pleased to advise interested readers the sources from which such material may be obtained

ORIGINAL XV CENTURY ITALIAN SACRISTY CUPBOARD
BOSTON MUSEUM OF FINE ARTS

THIS excellent example of Italian renaissance cabinet work formed a part of the Davanzati collection of Italian antiques. It was procured for the Museum at the Davanzati sale held in New York a few years ago, which was so largely responsible for the recent revival of American interest in Italian interiors and furniture. The illustration shows its setting in the Hall of Tapestries at the Museum.

The Architectural Forum

Interiors Adapted from the Italian

PART III. FLOORS AND TRIM

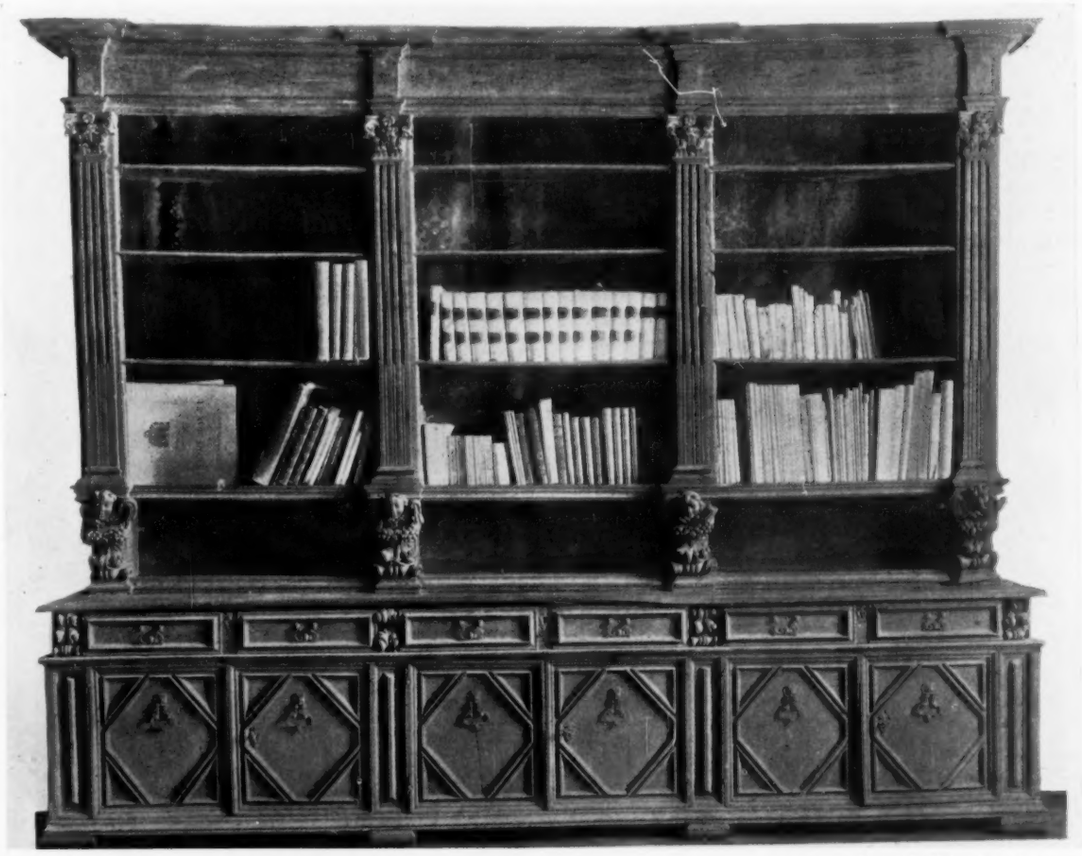
By WALTER F. WHEELER

IN planning interiors in the Italian style particular importance attaches to the treatment of floors, for with interiors so simple and direct in character it is necessary that floors be in keeping with their surroundings. The floor is essentially a foundation for the room and should suggest strength and solidity; for this reason the colors used upon floors should be darker than those in walls and ceilings and every effort should be made to use materials which by their very nature add an appearance of stability.

There are instances where floors in loggias, vestibules or entrance halls may be paved with flat stones of irregular shape, if not too rough in character. An extremely good treatment for use in such cases, or even for a simple interior where expense is a consideration, would be a natural gray cement floor lined off into squares, with narrow lines of black cement paint, or else every alternate square painted black. Such squares might be from 12 to 18 inches on a side and the lines themselves from ½ inch to ¾ inch in width. Cement offers many attractive possibilities in the usual forms of terrazzo or in combination with tile or metal inserts.

Brick, in various forms, provides excellent floors for rooms arranged in the Italian style and its moderate cost supplies another argument for its wider use. The well known Roman brick which is widely used in Italy for flooring is easily to be had in America and excellent results may be had by placing two such brick side by side and then cutting off the corners of the oblong thus formed making a hexagonal shape which forms a useful paving unit. Where a large surface is to be paved the expanse may be broken by bands of brick laid in a manner different from that used for the rest of the flooring and these bands may be of contrasting colors.

The use of quarry tiles marks the step to the form of flooring to be next considered. They may be had in a large number of colors and when choice is made of an appropriate color and a fitting contrast is obtained in selection of a color for mortar, a successful result may be expected. Tiles of many kinds are offered in the market and many are well



Courtesy Doubleday, Page & Company

Italian Wall Cabinet Suitable for Modern Bookcase Design in Italian Interiors
Example of favorite lozenge shape panels with raised mouldings

Original XVIII Century Venetian Polychrome Door
Courtesy of Paul Chalfin

suited to Italian surroundings. Their selection must always be governed by a proper regard for the reserve which in interiors of this type is quite necessary and it will be generally found that a single toned, undecorated tile of pleasing geometric shape will make a satisfactory, restful floor.

Wooden floors may be of several types and among them are parquetry and matched boards in geometric patterns. Wide boards, keyed together with the keys plainly visible, are highly appropriate and use might be made of oak or some other close grained native wood, stained to a dark, soft brown. These floors are frequently laid with square edged boards and with the joints purposely left open and filled with a black mastic compound that helps to create a sense of rugged construction.

The furniture workers of America, whose success in reproducing excellent examples of Italian furniture of the late fifteenth or sixteenth century has been already pointed out, have not been more resourceful in adapting the spirit of the older age to the requirements of today than the makers of floor coverings of different kinds. Unless an architect has given the subject a thorough investigation it would be difficult to realize the extent of the variety which is offered. Among the materials which are useful in furnishing interiors of the Italian type are many kinds of "fabricated" floor coverings, such as various forms of linoleum and a number of cork products such as tiles and carpeting. These materials are to be found in plain colors, in squares of contrasting colors, and also in tile and marble patterns, and since they are to be had in units of convenient size, are easily installed and give excellent service, they are being widely used.

The Italian interior is generally dominated by the fireplace. A study of illustrations of such interiors as are included here will show that considerable variety is possible in the treatment of mantels, but that almost all successful examples are of stone or of some modern substitute for stone or marble. Mantelpieces can be easily cast in cement from the architect's individual design, but the American market offers many mantels of various substances which are of excellent design and frequently exact copies or close approximations of mantels from well known Italian palaces and which are of quite moderate cost. In selecting or designing mantels for such surroundings it must be remembered that the scale of a mantel in an early Italian interior is quite different from that in the designing of a house based on Georgian or colonial precedent. In the Italian interior, the general scale is much larger; frequently the fireplace opening is almost high

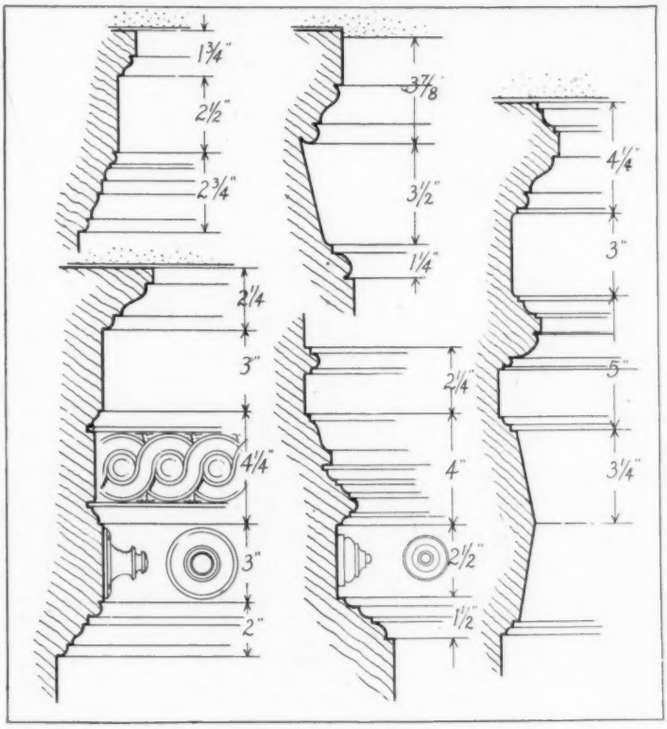
Window with Splayed, Paneled Jambs in Italian Style
Myron Hunt, Architect

enough to walk into and the effect, while lacking nothing in refinement, is far bolder and stronger and much more virile, in keeping with the more robust treatment of walls and ceilings.

There is considerable variety in the form which the Italian mantel may assume; the shelf of the mantel is not as important as with mantels of most other types, and frequently it disappears altogether. The "hooded" fireplace, which was inherited from the Gothic period, was often employed and it is much used today in interiors of this kind, for its form and general scale recommend it for rooms where lofty ceilings are the rule rather than the exception. Another favorite treatment called for the placing about the fireplace of merely a heavy bolection moulding which was generally of stone or marble. An instance of this treatment is illustrated and a section of the moulding is given on page 203.

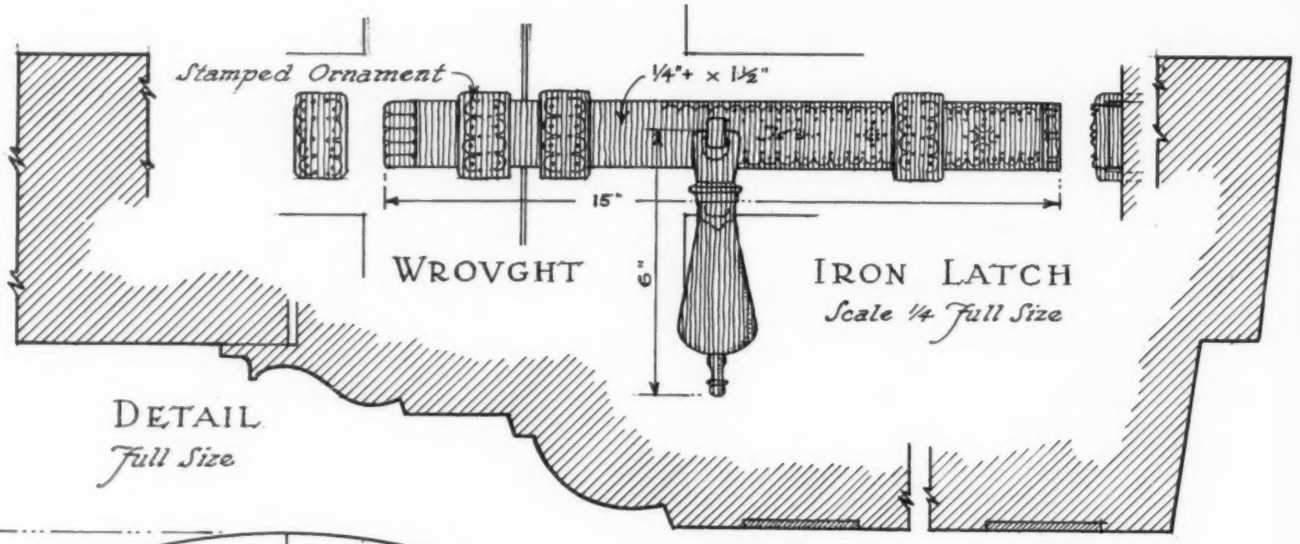
The highly developed chimney piece and over-mantel are not characteristic of this period except as the "hooded" fireplace may be so considered. The fireplace in the Italian room is nevertheless the dominating feature and this is achieved by the large opening and the vigorous moulding and carving of the stone mantel. The space above the mantel is generally left free for a tapestry, painting or sculptured ornament.

Doorway with Moulded Cement Architrave and Wood Paneled Doors in Italian Style
Bigelow & Wadsworth, Architects



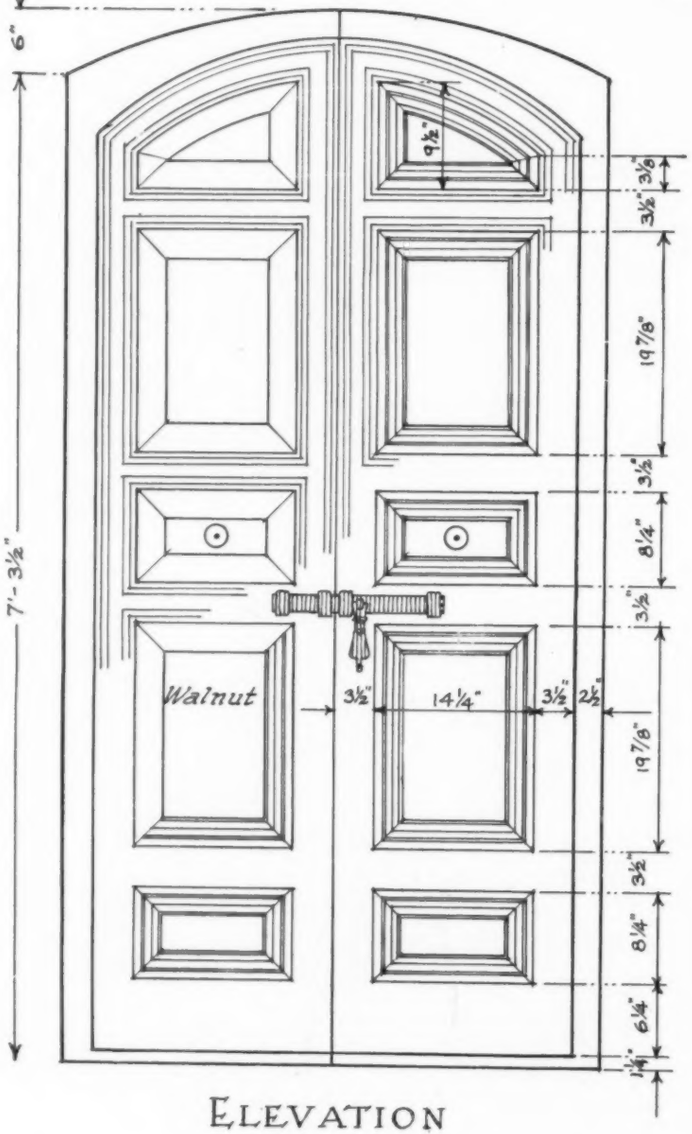
Details of Mouldings from Five Italian Wood Doors
All are reproduced at the same scale

Trim is also a matter of much importance. In the discussion of ceilings in THE FORUM for October it was pointed out that much of the success of a ceiling in an Italian interior often consisted in the presenting of a strong and abrupt contrast to walls, but just the opposite condition obtains in regard to trim about windows and doors or the arrangement of baseboards, in planning which the effort is to make them appear to be a part of the surrounding walls. It is true that sometimes—as may be seen in a few of these illustrations—the detail about a door may be of wood and as different as possible in appearance from the walls, but in these in-

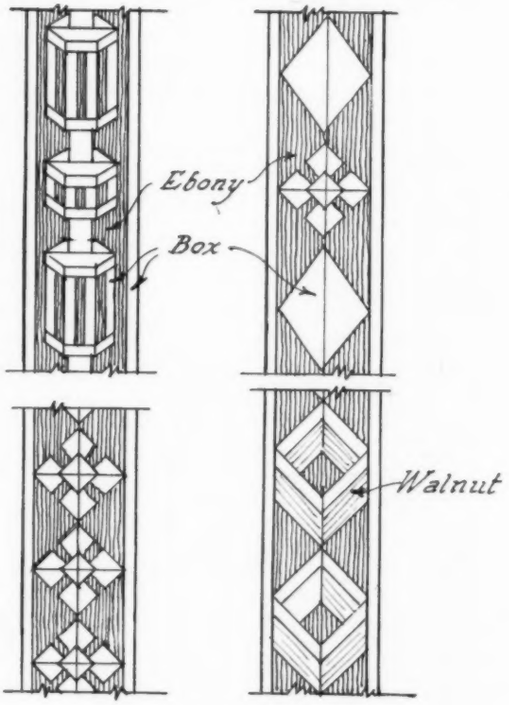


WROVGHT IRON LATCH
Scale ¼ Full Size

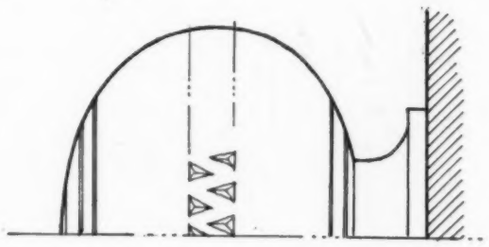
DETAIL
Full Size



ELEVATION
Scale ¾"=1'



INLAYS
Full Size



WOOD KNOB
Full Size

ITALIAN DETAILS 1921

INTERIOR DOORS PALAZZO DAVANZATI FLORENCE

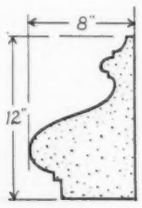
MEASVRED and DRAWN by HOWARD MOISE

stances the door frame is apt to be richly carved and probably polychromed and gilded, so that in effect it ceases to be a mere doorway and becomes an architectural asset of the first importance. Usually, however, the trim about doors and windows would be made extremely simple and inconspicuous—often flush with the plaster walls so that it was almost invisible, or else so concealed within the deep reveals that it was hardly noticeable, and almost always it would be painted or treated in some way to tie it into the walls, thus almost entirely concealing it. The baseboard, of course, was regarded as having only utilitarian value and was usually a mere protecting fillet a few inches high; often it was still further minimized and became a quarter-round at the angle between floor and walls.

In some instances, especially in rooms which are large and of considerable height, paneling was occasionally used to a height of five or six feet, with plaster or hangings above. Where paneling is used the panels should be in bold, vigorous scale, arranged in squares similar to English renaissance work but larger in size, often not less than two feet on a side and with a correspondingly vigorous cap. The mouldings of the panels may show some slight carving or use of carved beading and they offer as well an excellent opportunity for polychrome decoration in small areas of color.

Modern Door Designed in Accord with Italian Precedent
Richardson, Barott & Richardson, Architects

Among the important details of interior trim in the domestic architecture of Italy are doors and the wooden shutters or blinds which are often used. The older examples, made quite as much for protection as for architectural appearance, are paneled in various ways. These doors and shutters are



Above is Fireplace in Villa Caronia, Florence, with Detail of Moulding
Courtesy of E. F. Dodge

At Right are Two Mantels of Modern Manufacture, Based on Italian Originals

generally of walnut or chestnut, and like wooden ceilings are often polychromed or lightly decorated with gilt. Owing to the deep reveals made necessary by the thickness of walls, such doors and shutters are often surrounded by very little actual woodwork and in some old examples are fixed directly to the stone of the surrounding jambs.

Sometimes an excellent result may be had at a cost comparatively small by placing about a door opening a wide plaster band with face moulded edge; such a band, which really constitutes a form of trim, may be marbleized or given the same treatment as the surrounding walls for the slight shadows cast by the moulded edge will give the architectural emphasis which is required. It may be noted here that important doorways should be of generous width which of course involves the use of double doors. For such doors the Italian metal workers produced exceedingly well designed hardware—long strap hinges which extended across the entire width of the doors and huge locks, which were not mortised but left fully exposed. Sometimes the doors are studded with nails having richly ornamented wrought iron heads. American makers of hardware are particularly successful in their door hardware in the Italian style. To avoid too much cutting up of the walls only doors of real importance are given any architectural emphasis, minor doorways being often entirely concealed and made "blind" doors, which are almost invisible, since absolutely no trim is used and the doors themselves are precisely like the walls about them.

Much of the trim which is discussed here involves the use of mouldings which are of great importance in interiors of any type. The mouldings most successful in Italian interiors exhibit an accentuated difference between different members—some being robust, swelling surfaces while others are of small scale and quite deeply cut. There are however no sharp arrises, care being taken to round all edges to give a soft appearance. In paneling, the stiles are generally thin and narrow, the greater prominence attaching to the panel which is achieved by the use of wide mouldings which are often raised and frequently designed in the reverse, so that the depth of moulding coming toward the panel is greater than at the outer edge. The use of mouldings in interiors can be profitably studied from the furniture of this period because of its highly architectural character and the intimate relations which it sustained to the structural interior.

The treatment of windows follows, generally, that of doors. The more important windows were often extended to the floor and made to open, in the French fashion, in two folds. Owing to the depth of the walls the reveals would ordinarily be deep enough to take the windows or even the shutters which were sometimes used, so that hangings might be undisturbed on the plane of the main walls.

The thoughtful planning of the details of floors and interior trim goes far toward making a success of an Italian domestic interior, a type which depends for final effect very largely upon careful coordination of all the different parts to make up the setting or background which is afforded for furniture and other accessories.

A Modern Piece of Furniture Faithfully Reproducing an Italian Original and Carried by Dealers

Style of North Italian Early Renaissance. Length, 57 ins., width, 23 ins., height, 38 ins.